Contributions to Surgical Pathology and Physiology

Leg.

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Edinburgh University
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Contents

Introduction

Red must be looked at, in the light of
knowledge derived from activity of blood 2

Relative amount of corpuscles 4

Proportion of white : red 5

Proportion to age of individual 5

Quantity of white 6

Quantity of red 6

Chart illustrating above 7

Diurnal variation 7

Red corpuscles of man 10

Passages of double membrane 11

Effect of burns on blood 13

Microscopic constitution white corpuscles

Crops of white corpuscles 17

... red 27

... in uterus 22

... post 24

... from white corpuscles 26

... in foetus 33
Contents

Bone red corpuscles in lungs
- - - from endothelium lining vessels
- - - blood plasma
- - - hairy patches in gut mucosa
- - - liver cells
- - - spleen
- - - Effect of cutting spleen
- - - origin of red corpuscles in medulla bone
- - - in tissue cells
- - - from blood platelets
- - - My own methods of staining blood

Pec
- - - Dry maling method
- - - Dry + alcoholic

Nuclei always divide
- - - Description granules
- - - Constitution of nucleus
- - - Pericellular cells in blood
- - - Nuclei set free in blood
- - - Blood platelet, mit nuclei
- - - Derived from cells
- - - Experimental proof of origin
- - - White corpuscles in bone formation
- - - Matricules
Contents
White corpuscles increased in feces 104
Perfusionation white in circulation 108
Brod cells destroyed by metals and 109
Met metalld
Ink kind of binucleolar cell 112
Brod cell
113
Rapid hemesis spwhite corpuscles 115
Hydrocele metalld
Alumina granules 118
Kinds of white corpuscles
Nucleoli in white blood cells 122
Lecycoptosis (bacterial) 128
Experimental 132
Por 138
Gymn Por
Laudable 141
Por not allowed solely from impaled cells 144
Relation of Por to white corpuscles 148
“Healing by blood tissue” 151
Suppression of 157
Epithelial Por 156
Occular bodies in 157
Formation of conjugable lymph 158
Formation of blood in granulation 160
Contents

Maximum Maximum of Autosec 234
Danger of carboic magenta 237
Contributions to Surgical Pathology and Physiology

by Alexander Edington MS 

Having determined to enter into competition for the Lyne Surgical Fellowship, I did so at no loss for a subject of research, as from the time when I first became able, roughly to realize what "pus" meant, the question of the source or manner of production of this material was constantly before me. The various assertions made theories evolved as offering solution of this vexed problem did not I felt so far to help one either theoretically or practically; but I considered that very probably the blood had at least in many cases very much to do with such formations from thinking and reading much pertaining to this subject I became at last fascinated by it and my appointment...
to the laboratory of Professor Cline for me an opportunity of attempting an investigation of the subject. I began by making many close observations of pus, could not but be struck by the peculiar similarity of structure that existed between some forms of pus and white blood corpuscles. Hence naturally came to turn my attention to blood, its physiology and pathology. On this subject the scarcity of definite information and its great diversity as regards the themes of formation put forward, led me to devote much time and attention to it, until it has happened that for the space of the last two years, these daily devices to find some clue which would aid me in understanding how the blood corpuscles are formed, because I feel that if we were once possessed of definite knowledge...
in this head, we shined find it
like a veritable master, keep, capable
of opening the locked doors of
many chambers of mystery
and yet feel that it is quite
superfluous for me to render any
apology on behalf of what in
this essay appears to blood, or
more especially so, as most
of the knowledge we at present
possess about this subject, we
are indebted for to surgeons or
anatomists.

The Blood

Human blood consists of certain
microscopic elements floating in
a liquid, the Lympf Saumunis.
Of the former all are agreed that
there are at least two distinct
kinds, the white and the red cells.
Lately however it has been shown
that at least a third kind of
plasmatic body exists, termed
by Bizzaro, the blood plates or
lymphocytes.
These latter bodies have already given rise to much discussion, if the statements of the former authority are to be held as correct, which not only doubt but absolutely disbelieve, then they are bodies which should possess for the surgeon the very greatest interest.

The relative amount of blood in man in proportion to the actual body weight. Rutherford states that the blood itself makes up 1/3 of the total body weight. (lecture on Physiology Sec 2)

Carpentie states that in a man of average weight these glands from 12 to 15 pounds. Rigard gives as the result of his researches 1/2, 1/3, 5/12; Welch at 1/4.

Heidenhain, Valencia, Blechhof and others have from the results of their estimation for the lower animals & amphibians.

The relative amounts of corpuscles & plasma has been given by Rutherford as 1 to 2. Stricker finds 36% as the amount of corpuscles & plasma.
Specific Gravity

(a) Of blood as a whole 1045-75 average 1055
(b) = corpuscles 1105
(c) = serum 1028 (Wasse)

The normal S. G. of blood 1055 (Puttifford)

Relative proportion of white to red corpuscles

<table>
<thead>
<tr>
<th>White Blood Cells</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria</td>
<td>1.55</td>
</tr>
<tr>
<td>Malaria</td>
<td>1.55</td>
</tr>
<tr>
<td>Malaria</td>
<td>1.55</td>
</tr>
<tr>
<td>Rubricy prm.</td>
<td>1.55</td>
</tr>
<tr>
<td>Donders</td>
<td>1.55</td>
</tr>
<tr>
<td>Kollek's</td>
<td>2.55</td>
</tr>
</tbody>
</table>

Minimum 1.55 709
Maximum 1.55 115
Average of 28 persons 1.55 357

Quantity of red corpuscles in 1 cubic centimeter

in relation to age of individual

2½ to 75 years

<table>
<thead>
<tr>
<th>Age</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3,059,99</td>
<td>4,269,9</td>
<td>4,269,91</td>
</tr>
</tbody>
</table>

20 to 30 years

<table>
<thead>
<tr>
<th>Age</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4,999,325</td>
<td>5,332,000</td>
<td>5,332,000</td>
</tr>
</tbody>
</table>

30 to 55 years

<table>
<thead>
<tr>
<th>Age</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3,266,250</td>
<td>5,704,075</td>
<td>5,704,075</td>
</tr>
</tbody>
</table>

Average

<table>
<thead>
<tr>
<th>Age</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3,059,99</td>
<td>4,269,9</td>
<td>4,269,91</td>
</tr>
</tbody>
</table>
Total average irrespective of age
24,771,094 per 1 cubic centimetre

Quantity of white corpuscles per cubic centimetre

<table>
<thead>
<tr>
<th>Age of Individual</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 years</td>
<td>761</td>
<td>12181</td>
<td>6704</td>
</tr>
<tr>
<td>2½ - 15 years</td>
<td>2284</td>
<td>7512</td>
<td></td>
</tr>
<tr>
<td>20 - 30 years</td>
<td>11306</td>
<td>6113</td>
<td></td>
</tr>
<tr>
<td>30 - 55 years</td>
<td>14465</td>
<td>6931</td>
<td></td>
</tr>
</tbody>
</table>

Total average irrespective of age
6307 per 1 cubic centimetre (Dulbecq, trans. 1876)

Proportion of white blood corpuscles according to age of individual

<table>
<thead>
<tr>
<th>Age</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>2½ - 15</td>
<td>1 - 0484</td>
</tr>
<tr>
<td>20 - 30</td>
<td>1 - 708</td>
</tr>
<tr>
<td>30 - 55</td>
<td>1 - 616</td>
</tr>
<tr>
<td>2½ - 12</td>
<td>1 - 226</td>
</tr>
<tr>
<td>30 - 50</td>
<td>1 - 346</td>
</tr>
<tr>
<td>60 - 80</td>
<td>1 - 381</td>
</tr>
</tbody>
</table>

Dulbecq 1876
Moleschott 1854
Chart showing proportion of white to red corpuscles in proportion to individual age. These compiled thus from the latest estimation.

<table>
<thead>
<tr>
<th>Years</th>
<th>White Corpuscles</th>
<th>Red Corpuscles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2½-15</td>
<td>6900</td>
<td>4300000</td>
</tr>
<tr>
<td>20-30</td>
<td>6800</td>
<td>4270000</td>
</tr>
<tr>
<td>30-55</td>
<td>6700</td>
<td>4240000</td>
</tr>
<tr>
<td></td>
<td>6600</td>
<td>4210000</td>
</tr>
<tr>
<td></td>
<td>6500</td>
<td>4180000</td>
</tr>
<tr>
<td></td>
<td>6400</td>
<td>4150000</td>
</tr>
<tr>
<td></td>
<td>6300</td>
<td>4120000</td>
</tr>
<tr>
<td></td>
<td>6200</td>
<td>4090000</td>
</tr>
<tr>
<td></td>
<td>6100</td>
<td>4060000</td>
</tr>
</tbody>
</table>

In the above chart the numbers at the side represent respectively the numbers of the white red corpuscles contained in one cubic centimetre of blood.

Numerical variation in relation to meat.

Pencil of day 46

Most authorities agree in stating that there is invariably a distinct numerical increase in the white corpuscles after a meal (Hart, Moley, St. Domin); and it therefore is most instructive to consider the statistics furnished us.
8 o'clock a.m. breakfast  
1 - 1760
8 - 9  
1 - 700
9 - 10:30  
1 - 1510
1 - 2 p.m. dinner  
1 - 1370
3:30  
1 - 1480

List B

8:30  
1 - 550
10 - 11:30  
1 - 1230

Before breakfast  
1 - 716
30 minutes after  
1 - 347
2 or 3 hours later  
1 - 1544
10 minutes after dinner  
1 - 1592
30 " " "  
1 - 429
2 1/2 - 4 hours later  
1 - 1481
30 minutes after coffee  
1 - 544
2 1/2 - 3 hours later  
1 - 1227

In List A & B it showed he noted that the number of white corpuscles is supposed to remain constant and it is only the white corpuscles that are supposed to rise or fall in number.

Considering these statements, we note that the increase in
the numbers of the white corpuscles, always
taken place, soon after a meal is taken.
Then a gradual decrease is observed
up to the time of the next meal.
It is obvious, of course, that such
statistics are faulty in that we are
left in the dark as to the fresh
amount of red corpuscles.
I believe however that the numerical
standard of the red corpuscles from
hour to hour is fairly well maintained.
I have therefore to ask ourselves:
What becomes of the white corpuscles
which evidently disappear between
meal time? Do they disappear
by a process of solution, or do they
pass into some other stage of being?
To order clearly to understand
what I am about to speak of
must not refer to permissible
blood, it is necessary for me
to shortly detail some points con-
cerning the morphology, constitution
of the red and white blood corpuscles,
more especially as I differ from
The red blood corpuscles of man

These bodies are true cells, but unlike most cells do not possess a nucleus, although Böttcher affirms that they do. They are circular disc-like bodies, crescentic in each side, possess in their fully developed condition a pale yellow colour. Morse in a paper lately published in Hoch's Archiv, states that the crescent disc-like form is a pathological condition, but he considers himself justified in making such an assertion as difficult to understand.

The red cells are stated to measure from 7-8 μ in diameter (Gray's Anatomy 9th edition). I think this statement is somewhat incorrect, as one may readily find many measuring 10 μ in diameter, quite as many that are 5 μ in diameter, though 7-8 μ is somewhat near the average measurement. In addition I have here to note that not infrequently in healthy persons the corpuscles of
Cutaneous anemicosis. Smaller red corpuscles (murecyle) are thrown. 

Who has been supposed by Roberts that the red corpuscle possesses a 

double membrane. I am very decided in my own opinion that he is 

quite correct in believing this. 

If one adds to a drop of blood some fluid of a slightly less density 

such as weak saline solution, 

certain peculiar appearances in the 

red corpuscles are observed, 

forming some of them the appearance of possessing a nucleus. I first noticed 

this peculiar condition when examining 

the fluid from an emphyema, in which 

some blood had accidentally passed. 

In plate I are represented the peculiar 

changes which a corpuscle passes 

through before this condition is 

arrived at. Undoubtedly the change 

is hump; about long a process of 

removal. It will be remembered 

that the red cell possesses an intra- 

vascular system, in virtue of
which it retains its characteristic form. This network is supposed
the thinnest at that point where
strength is most needed, namely
between the two concavities.
Supposing then that we have placed
a mixture of blood and the fluid
on a slide, we will see the filling
for present changes
1st. One of the concavities will lie
seen the less well marked than
the other
2nd. The flattening of one side is
more distinct
3rd. Looked at sidewise, the concavities
seen to have disappeared, but just
within one side a peculiar dark
appearance is visible. What has
taken place has been a rupture of
the intrapapillary network opposite
the previously flattened concavity.
This followed by a breaking of the
wall at this point & succeeded by
an extravasation through it of the
contained hemoglobin, which being
arrested by the outer envelope associated in this situation. This rise in the way to the peculiar darkness. 

Still later the corpuscle became almost perfectly spherical, still seeming possessing the appearance of indelation.

5. Lastly a process of analysis the hemoglobin passes through the outer wall. The corpuscle remains, as a perfectly spherical colorless body, the invisible corpuscle" of Norris.

From a study of the above changes, it will be seen that the corpuscle must certainly possess a double membrane or wall, that the power of resistance of the inner wall depends on the strength of the internal peripherye network, the normal unpeneetrability of the outer wall, rather than upon its own.

The fact of there being an inner membrane is clearly demonstrated, when the streams of hemoglobin take place. At the
period of me selects a corpuscle lying in the position of fig. 1 Plate I. It will be seen by careful focusing that in the position marked A there is a delicate membrane or film rather tightly stretched between the horns of the crescent B + C. Now if this same corpuscle rolls over so that the fact D becomes most superficial, the extravasation of hemoglobin will produce the appearance of a nucleus. The whole corpuscle will appear like that in fig. 11 Plate I. The presence of an inner membrane is not so easily demonstrated but may be inferred, because if there is no such structure, why have such an extravasation take place. One shelled effect under such a condition that the first films would merely swell up and remain uniformly tinted.

The form of the white corpuscle is found
trying considerably, but when at rest it approaches the spherical. Looking at the white corpuscles generally as apart from the red corpuscles, one may state that they vary in size from 5 to 10 μ. In other words, one finds "white" corpuscles smaller than the average red corpuscle. From this, ranging sizes are seen in the tissue which are simply speaking twice the size of the average red corpuscle. But here we have to remember that the white corpuscles especially the larger ones have a constant tendency outside of the circulation to spread themselves out. Thus it is fallacious to estimate their size in blood by a line between a cover-glass and slide. In many respects the larger white corpuscles approach the type of a free animal cell or a mass of protoplasm of the most primitive kind enclosed in a distinct cell wall (this is

Possess several nuclei from one to seven, the average being three. Such of them as possess several nuclei & much perinuclear protoplasm exhibit well marked amoeboid movements, while others of the uninuclear type with little protoplasm are permanently little. This may be easily explained by considering that in all probability the power of amoeboid movement depends upon the protoplasm, & so many exist almost entirely of a single large nucleus & only a faint ring of perinuclear protoplasm equally disposed around the nucleus, it necessarily follows that mobility should be almost or entirely absent.

The white corpuscles, at least three of the neutrophilic are able to take into their interior particles of foreign material & will be
remembered that this peculiarity was taken advantage of by Claudean in certain of his experiments.
As the functions of the white corpuscles are much as forms vary much to do with hematogenesis, while other claim for them under certain conditions a hemolytic function. We may hence leave such considerations over for the present until speaking of the formation of blood plasma.
After speaking on the subject of hematogenesis, it will be much easier to define the white corpuscles. These varieties:

**Origin of the White Corpuscles**

From the great unanimity which exists in the minds of all authorities, we may conclude it as most probable that the lymphatic glands are at least one of the chief seats of origin of these bodies.
of the corpuscles. As a rule, it has been assumed that such a division is
followed by that of the corpuscle itself. It must be remembered that
Heine and Strasburger, others have described the "karyokinetic process"
occurring in some animal and vegetable cells, all for the most part
of a most complicated description, to which the term "indirect division" is applied as
distinct from "direct division" in which it is assumed that the
nucleus simply becomes just
constructed from subseparate aside,
being followed then by division. The egg itself.
I do not propose at this stage
to discuss the various statements,
many of a most contradictory
nature, which have been advanced
with regard to karyokinesis in
animal cells, but will reserve to
the subject when considering
the important question of karyokinesis. It is important however in
this connection to note that we have
in the case of human blood only. The very barest evidence shows that
division of the white corpuscles takes place at all, in fact it is limited
to a statement of Dr. Klein, that he has seen the occurrence, but rarely.
He describes it as seen in the tails of certain amphibia, but I feel that
it is scarcely justifiable in our part to consider what takes place
in the corpuscles of cold blooded animals as pointing any analogy
to the changes obtaining in the blood of mammals. For my
own part I must say that I have
never seen in human blood any
indication whatever of the division
of white blood corpuscles. I am the
somewhat suggestive fact that
the blood vessels running from
lymphatics to contain white
corpuscles in much greater number
than the afferent vessels do, it has
been considered that they are
formed for the most part in ducts
Plants. Further it has been shown by Hughes Bennett that in Leucopenca the presence of excessive numbers of white corpuscles in the blood is associated with hysterephy of the plant that plants the body, somewhat in Deparein. Here is the statement of Dr. Robinson in Strikes. He states that it is impossible to ascribe the origin of such corpuscles solely to an intravascular process from the fact that there are no true lymphatic glands in the Amphibian. Here again however I would again refer to my previous statement that there is no distinct analogy to the blood between Amphibian and Mammalian blood, that some radical difference does exist I think may be ascribed from the fact that in the former the red cells are always nucleated whereas in the latter accepting the short period of intracutaneous life
the condition is exactly the reverse.

It may then I think be accepted from the fact that such a new

is accepted by most authorities,

that the placenta are the chief seat

production of white corpuscles,

but in addition to this the view

which hold that after the birth

of such corpuscles into the general

circulation, they in some way

undergo proliferation to I think

much worthy of consideration.

Origin of the red corpuscles

A In utero

B After birth

A In utero

It is now a well ascertained fact

that fetal blood corpuscles, up to a

certain period of intra-uterine life

are characterized by the possession

of a distinct nucleus. They are

considered blue developed amniotically

- connected with the blood vessels

in a circular area of the mesoderm

turned the vascular area.
Klein has shown that certain of the cells take on peculiar changes, the processes of neighboring cells fuse together, while at the same time the nuclei actively proliferate while most of these remain within the area of the cells themselves. Others pass into the processes, which becoming hollerned out form a branched system of small tubes, embryonic blood vessels. The nuclei remaining in the cells are seen to acquire a certain amount of perinuclear protoplasm, which later acquires a reddish tinge of the cells, processes and being vacuolated hollerned out we have an embryonic system of vessels of blood corpuscles. Schaper described a modification of this method occurring in the connective tissue of the newborn rat. He noted that in certain of the connective tissue cells, part of the protoplasm
acquired colour that later this
was condensed into the form of
franules of common pork that
these prematurely attained. The
cage red blood corpuscles,
to
patches of such cells containing
red corpuscles, the term "blood island"
is applied. By forth the cells or
the formation of fluid in which
the grouped corpuscles float, we
have a true intra-cellular for-
ation of blood. These cells later
open into one another, forming
already formed blood vessels
in this way the cells formed
become part of the general circulation.
These precaution nerves are of the
greatest importance, the one dealing
with the distinctly embryonic
period of mammalian existence.
The other with that which connect
the intra-uterine with the post-natal
life. The question then arises
that we any process of blood-
formation at all analogous during
later life? The answer to this question may perhaps be gleaned from the observations these made of adult mammalian blood.

**Blood formation in late life**

Investigations on the mode of hemopoiesis in adult life have been conducted by numerous observers, some of whom have limited themselves to the examination of blood after removal from the general circulation, whilst on the other hand few for the greater number have published their results as being deduced from observations made upon various organs and tissues of the body.

A difficulty is at once experienced when one attempts solution of this problem, i.e., examining the blood outside the circulation, in that the corpuscles probably are of all the cellular constituents of the human frame the most sensitive to alterations in their environment.
Mons Pouchet in 1878 emphatically this fact with relation to the white corpuscles, in saying that "the moment that a leucocyte has become inactive it is no longer in its normal condition." Moses in 1887 goes a step farther as he has already noted, when he states as a result of his observations, that the familiar "honeycomb" discoid form of the red corpuscles is the direct effect of changes in environment producing a condition of necrobiotic, or as such being a degeneration form derived from a former spherical condition.

One need hardly affect any astonishment, on hearing of such a statement, as the most conflicting theories have been propounded on this subject, nearly every tissue in the body has, at one time or another, been supposed to serve as a seat of origin of the red corpuscles.
I shall content myself with a somewhat hastily penned up the published literature on the subject and shall then append there to my own observations upon the most interesting process.

Origin of red eyespots from white opales.

It is a somewhat remarkable fact that the production of these, bearing upon this subject, has suffered what might be almost considered a cyclical change. That 15 days that from having been somewhat evolutinary, there has been an involutinary process, as that theories put forth more than a century ago, are now today stated but for the world with but little modification as new. He even considered that the white eyespots became changed into red, during their passage through the larva, Donné in 1842 declared that this change took place in the
general circulation, by the leucocytes becoming more and more spherical and acquiring colour, while their granular contents became either dissolved or absorbed. The same observer recorded observations of another element in the blood, the full importance of which has not yet been fully realized, which will be referred to in its proper place later in. He gives few details with reference to the supposed transformation of white and red corpuscles; states that intermediate or transitional forms are rarely observed, partaking of the nature of each kind, having peculiarities like the white, in their resistance to chemical reagents while possessing somewhat of the form or colour of the red corpuscles. Much of the literature has to deal with the blood of Anechidia, & it is of the utmost importance to draw a sound first line of
Distinction between that of the higher mammalia.
The white red corpuscles of
the former show considerable
similarity, both being possessed
of nuclei & without regard to their
it is maintained that the
red corpuscles simply lose
their granularity & acquire
hemoglobin & thus become red
corpuscles. In human blood
on the other hand, the white
corpuscles differ most markedly
from the red; in the process of
mature red corpuscles only may the former, in
size, form, resistance to water
& other chemical reagents.
If then it should be urged, as
it has already been by some
authorities that the red corpuscles
are simply transformations of these, what then. It may well
be asked becomes of the nuclei?
If the contained vitreous
granules, & further in what manner
Are large cells like that of the white become changed into a smaller cell like that of the red?

Is the nucleus or nucleoli simply extended, or does it undergo retrogressive metamorphosis?

With regard to this it may be noted that the multinucleated condition of the pus cell, which is in most cases the homologue of the leucocyte, is held by several authorities to indicate of degenerative change.

Koller and others consider the red mammalian corpuscle those the morphological characteristics of a cell, so to entirely correspond to the red or parasitic corpuscle, the cellular nature of which is at once undeniable. They consider that the method of change is the same in both cases, one that in the mammalian corpuscle the nucleus disappears.

Among others, Sullivan, Martin Jones, Brooke, Hadley, Balfour, Bennett maintain
that the red corpuscle is the nucleus, or rather has been the nucleus of a cell. That cell, they consider to be a white corpuscle.

Pouchet and several others, on the other hand, hold that the red corpuscle is neither a cell nor yet a portion of one, that it is not even derived from such a unit, but is the product of a working together of certain normal elements in the blood plasma, which have become united or fused together in some occult way, somewhat after the style of that which obtains in the phenomena of crystallization.

Kolliker (in a paper *Zeitschift für med 1842*) details his ideas on hematogenesis and admits only three theories as being at all worthy of any consideration: viz.

1st that the red corpuscles are formed from the nuclei of the white, or at the first glance several facts seem to plead in favor of such a theory.
(a) The forms of the nucleus of small leucocytes, are somewhat similar to red corpuscles.
(b) In mammals, the form of whose red corpuscles is elliptical, it is noticed that the nuclei of the white corpuscles are also elliptical (Wharton Jones).
(c) One never finds the nucleus of a white corpuscle undergoing any atypical change.

In (a) it is probable that the small leucocytes referred to are of the unimolecular lymphoid type.

(2)(c): this statement is really faulty, as authorities are found to consider that the nuclear division which obtains in the white corpuscles is the result of retrogressive metamorphosis.

(d) Leucocytes have been found containing red fibres in their interior.

This theory however I think is best rejected by a study of the reaction of red white corpuscles to certain chemicals. In eating solutions we find
the red blood corpuscles severely charged by osmotic processes, while the white corpuscles, on the other hand, are but little changed in their nuclear content if at all. I shall treat of this more fully hereafter, when considering the action of absorbent agents on the blood corpuscles generally.

According to this theory, the red corpuscles are produced from white corpuscles, of which the nucleus, cellular protoplasm, and cell membrane become completely interchanged. H. Müller, the author of this last statement, urges that we never see the residue of the cellular membrane of the white corpuscles, while that of the nucleus is easily seen. That a leucocyte thus altered, very much resembles a red corpuscle, while it also seems that such a form ever does or can take place.

(3) He admits that the nucleus of the leucocyte also appears to that...
the latter becoming charged with
colouring matter becomes a red
corpuscle & cites many arguments,
which nevertheless are just as much
against as in favor of such a
view.

(a) The lymphatic follicle gets
more & more solid in proportion
to age & shows a tendency to
atrophy, in order to set free its
nucleus.

(b) One finds among the white
corpuscles, those of which the nucleus
is wholly or partially disseminated
at the cell border shows a
depression on its side. (Passer at Duhraper)

(c) In general of the red corpuscles
one finds a nucleus (Bolcher)
This last observer states that such
are the semi-liquid alcoholic solution
of corrosive sublimate.

Grant Journal of Cases &c. 1877

(a) The small lymphatic corpuscles
of the thoracic duct are of the
same size or less than those of the
red corpuscles

(2) Their membrane is of the same nature as that of the red corpuscles as it is in the same reaction with acetic acid. On preparing the liquid in which they float, they become ornamented and alternated, exactly as those of the red blood corpuscles.

(3) Their forms are flat like those of the red cell.

(4) In mammals with nucleated red corpuscles, the red colour is contained in the nucleus; the red mammalian disc being the only exception.

(5) In all other animals, the blood corpuscles losing the distinction of cells, it follows that they are the same in mammals.

(6) In the embryos of sheep and man, the nucleated red corpuscles, by colloidal process change into non-nucleated corpuscles.

Among others, Schucké, Papenheer, Hense, Roth, hold that representation...
of the nucleus of the white corpuscle occurs, before it is set free and acquires color, preparatory to its deposing as a red corpuscle, that is to say, the nucleus divides, acquires color in its divided portions so that these divided portions each become red blood corpuscles.

Gullier Hosseini believed that each primary nucleus became divided & acquiring coloring, took upon itself the role of the red corpuscle that in fact merely amounted to a repetition of the much earlier affirmation of Veron.

Section of the red corpuscle

Dr. Laockhennoth stated to have observed such a phenomenon taking place in the blood of a patient who was at the time suffering from Addison's disease. Neither Heidel or others had also described this peculiarity.

Remak, OwenBessey,Heynryff also mention having seen similar phenomena.
Bacteria has announced such a
theory as a result of experimental
observation. He found that if a
current of oxygen and carbonic acid
was passed into a solution of
Haemoglobin, a fine precipitate
was deposited, the separate molecules
of which corresponded in dye with
red corpuscles. Criticism is quite
unnecessary to show the utter
absurdity of such a theory, still
it has happened that as late as
the year 1870 one finds a statement
made by M. Bockamp et al.,
which referred to by M. Auring, who
has quite as little to recommend it.
They say that when fresh blood is
mixed with alcohol, a precipitate
occurs which consists of "Bacterium"
that these have the power of proliferation
by the action of which they may
be converted into white or red corpuscules
or even bacteria!! They insist that
the red corpuscle consists merely
If a mass of such bodies enclosed in a capsule of membrane
in 1843-45, Schickly described a method of
formation of red corpuscles from the cellular elements lining the
terminal arterioli of the lungs.
Such a statement one cannot consider correct only take its rise
in a faulty observation of the histological structure of such
a tissue.

**Origin of red corpuscles from the endothelial lining of blood vessels**

Remark in 1842 advocated such a theory, which however can have few supporters in these days of advanced histological methods.

**Origin of red corpuscles in blood vessels**

Humphrey Bennett was a supporter of such a theory with reference to the
blood vessels. Similarly, while Bertholf specified the thymus gland, from the
results obtained in stimulating meningiog.
its units. Triebelmann states that after laceration of the thymus gland there is a diminution of the red and an excess of the white corpuscles of the blood. Brown-Sequard also states that after laceration of the suprarenal bodies, there ensues a distinct hypertrophy of the thymus, thyroid glands and also of the spleen. The absence here of these lymphatic glands in fish and amphibia tends to support such a theory as pertaining to the spleen. Pouchet reminds us that in certain animals the spleen is absent.

Origin from "milky patches" in the Peritoneum:

Ranier considers that certain white or milky patches on the omentum are a seat of origin of red corpuscles. In considering this statement it is well to remember Schaefer's observation of red corpuscles being developed indefinitely in
Cutaneous tissue cells of new born rats

Origin of red corpuscles in larva cell

From the fact that in the embryonic nucleated corpuscles, begin to puff out distinct diminution coincident with the formation of the liver, many observers maintain that it has much to do with the formation of the uninucleated red corpuscles. However most authorities now agree except in a opposite view, namely that this organ partakes more of a hematopoietic function. Among the supporters however of such a view, are the renowned Weber, Pettenkofer, Wohler, etc. Weber states that in frogs, after the cessation of the winter's hibernation, the liver is of a yellow colour and the bile ducts are filled with small cells, which he considers become transformed into red corpuscles.
Kolliker is somewhat inclined to admit Weber's theory as correct with this modification, that these cells are formed in the blood capillaries just outside of the liver.

Moleschott in 1853 stated that in the blood of frogs the white corpuscles present only amount to one eighth of the red. If, however, the spleen be removed the white increase to one third of the whole corpuscles. He then considered that the bone was the active agent in transforming the white into red corpuscles.

Hart of Jülicher states that in the blood of the frog the white corpuscles are present in the proportion of 1 to 324 red corpuscles, while in that of the rabbit and the ratio is 1 to 136. This implies that during its passage through the liver substance either the red corpuscles have suffered diminution or the white
erythrocytes have become augmented in number. The blood in the hepatic vein has also less tendency to form rouleaus or less strongly acted upon by uric acid than is that of the portal vein. Taken in the light of Monsen's researches, it might be considered that of the mass of red corpuscles entering the portal vein, the "less resistant" suffer destruction. Burchardt's recent work states that in the liver the hemoglobin is destroyed or certainly in the condition of pernicious anaemia the researches of Hunter for Hemoxylin emphatically that this is so. Origin of red corpuscles in the spleen. M. Pouget has repeated the observations of previous workers holds with them that the spleen is not at all essential for the formation of regeneration of red corpuscles. At the present day. Pernicous disease to be depended on the blood functions of this organ.
Some consider the spleen to be essential for the formation of red corpuscles; others that in it such bodies are destroyed, while yet a third set considers it to have a twofold function of forming new red blood corpuscles and destroying the old ones.

Delage considers that three methods of inquiry may be instituted with regard to this
1. The excision of the spleen and the observation of the results produced thereby
2. Comparison of the blood in the splenic artery with that in the corresponding vein
3. A study of the histology of the gland and a comparison of its cellular elements with those of the blood as studied in younger cells

In 1867 Malfettie ligatured the pedicle of the spleen in order to make a study of its function.
Pursh in 1672 noticed that several
numerous others among whom
are Flint, Halton, Dupuytren and
Colin, experimented on numerous
animals with equally curious
results. Owen excised the spleen
of a young woman who died very well afterwards. Leprosy found
animals who had suffered
splenectomy recovered. Traumatism
may badly hurt, but H. Maistre states
the opposite result as obtaining
on March 12, 1887. S. Peracemeni
successfully excised the spleen of
a woman aged 40, a year after
the date, patient was in possession of
good health, setting the blood
contained only 3,000,000 red
corpuscles & 1600 white corpuscles
per cubic millimeter. So that
we are in a position to infer
that the spleen is not essential
to the formation of blood.
M. M. Malassez & Picard state
that in animals splenectomy
The following results obtained:

1st. Determination of the red corpuscles
2nd. Hemoglobin per corpuscle.

This agrees with the case just noted.

Still later Dr. Reid observes that the results of splenectomy will vary according to the age of the animal. The younger the animal, the better will be its chance of surviving. Those of middle age will only perform a compensatory hypertrophy of the lymphatic glands. With regard to the latter observation one should like to know if the glands which are supposed to suffer hypertrophy taken in the somewhat different nature of the splenic tissue. Tulpeani observed that after severe loss of blood, augmentation in volume of the spleen occurred.
Comparison of splenic arterial with that of splenic renino blood

Consider the

First of Zittau white corpuscles in the splenic artery were present in the proportion of 1,53000 red corpuscles while in the corresponding vein the white corpuscles were present in the ratio of 1,670 red.

Tschachnoff found that the absolute number of white corpuscles is numerically greater in the splenic arterial than in splenic renino blood.

Spleen renino blood = 8200 per 1 ccm.

arterial = 7600

Weyerst found in the spleenic reni of a criminal 4:9 white to 1 colored Molecules. But agrees with his view of this statement.

Malacovsky and Rehard state that in 1 cubic milliliter of splenic renino blood there are 5,352,000 red as compared with 5,072,500 red in ordinary arterial blood. That in the former, the red corpuscles are paler and do not pour readily into
Prolonged, indicating that they are newly formed.

Draper cites Kolliker's view in Brown's "Spleen" that the function of the spleen is destructive rather than formative, as in the red corpuscles, as these are the found in every 1 in 83 of altered shape, while compositional corpuscles are only found in the number of 40 in the blood of the horse. Bedard finds that in the horse, where the blood of the splenic venal always has fewer red corpuscles than those of the femoral artery and general arterial blood. He finds 16% more white corpuscles in the splenic venal than in the splenic venal.

Spleen is held in equilibrium with splenic function. The balance of evidence thus rests in favor of the splenic venal having a greater proportion of white corpuscles relatively to the red, than what is found in the splenic arteriole.
& this may be lumped about in one of two ways, viz. either red corpuscles in their passage through the spleen suffer a diminution by destruction or the spleen forms new white corpuscles. In this may alter the perfusion. But as noted, the most reliable statements seem to show that there is really an absolute diminution of red corpuscles in the spleenic region further as analysis of spleenic tissue yields considerable quantities of iron it seems very probable that in the spleenic red corpuscles are in a measure destroyed & we can also in mercury essece & amniotic fluid white corpuscles with much down red ones in their intestines.

In latter years however, Maloney & Reid have shown that the spleen is subject to alternate contractions & dilatations. They have endeavored to study it under each condition, they have made numerous
enumeration of the capillaries or estimation of their value as regards hemoglobin.
Before nerve section, they found the renal blood vessels in capillaries than the artery. In section of the nerves, the spleen is paralyzed while its function remains active. The difference now becomes great but is still not evident. The stimulation of the nerves causes contraction. The difference then becomes so small as to be almost imperceptible. They have therefore resorted to studying different portions of the organ; one part being kept in its normal condition while in the other the nerves are divided. As a result, they have formulated three hypotheses.
1. The spleen at one time stores up and withholds the red corpuscles for use in human life.
2. The augmentation is the result.
Sympathetic supply, i. e., the organ
3. The spleen is a former red
   corpuscles.

Against the first hypothesis, they
place the result of their observations
during the condition of extreme
constriction. In this state they find
less red corpuscles in the vein
than in the artery.

Against the second, they state that
the sympathetics of the organ are too
few to account for the supply, so
they therefore accept the second
as correct. In order however to
establish such a theory upon
a secure basis, they have
endeavored to find in the
spleenic tissue, the principal
elements which go to make
up the red corpuscles. Those in
this way recognized for service
at or near the end of the
hematomegaly
they forced out the red corpuscles
of the spleenic tissue, by the
injection of salt solution.
The experiment is performed through the artery. The liquid passed by the vein. After a time the liquid passing from the vein becomes colorless. If now the neutral indifferent salt solution is replaced by distilled water, which is known as the blood of the swimmer, the current becomes colorless by it.

This experiment however only proves that hemoglobin free or included in less easily destroyed cells is present in the spleen pulp. Might just as easily be held as proving the spleen pulp a seat of corpuscular destruction. Observations of splenic tissue funke & others have tried to show that forms indifferent between the white and young red cells are the recognized in the spleen pulp some years ago were considerable interest now attached by certain authorities to the so-called
"Blood-corpuscle-holding-cells" (Blutkorperchen-haltigen zellen) collitese held with regard is true that they were formed by formerings of red blood corpuscles just emulsified in a definite membrane, but we now learn that the "definite membrane" is nothing less than a vacuole while corpuscle. Such bodies are not at all uncommon near the side of extravasated blood. Such bodies are possibly also very nearly related to the so-called leukocytes of Remmen. 

The dermis of the spleenic remi is tender with hemoglobin. It has seemed more than probable that the hemoglobin is here set free, thus giving the dermic the red color. Origin of red corpuscles in the medulla oblonga.

In all times except the last caudal vertebrae, the mucous remains of a red color, hardly as we find it in the fotal state.
M. Neumann and M. Bizzozero disputed as to which of them belonged the honour of first describing certain elements of red marrow, which were in their opinions morphologically identical with red blood corpuscles excepting the fact that they possessed a distinct nucleus, which they concluded were indeed young forms of red corpuscles.

In pure red marrow there are two kinds of cells, called respectively by M. Robin, "medulla cells" or angelliplaque. It is held that of these the former are lymph corpuscles, and Robin has resisted this allegation for this reason that he found by the use of cresyl violet only the nuclei of the medulla cells retained, while in the lymph corpuscles or leucocytes the nuclei of the phagocytes are equally stained. Neumann considers that the medulla cells become changed
with red blood corpuscles, having their nuclei and absorbing colour in the course of transformation. Oxygynia on the other hand includes a series diagnostically opposed to this. He considers that the nuclei of such cells are bodily stripped and become at once red blood corpuscles as that here we have the same condition of dispute as stated in the white corpuscle theory, with the simple exception that a finer locality is cited for the seat of such changes. There are those who hold that the medulla of bone present certain similarities to the splenic pulp, that is to say that these are the blood spaces in the former; blood corpuscles in the latter. In the spleen we have large cells including demintegrated red corpuscles, while the medulla we find similar cells with

different names, such as the myeloid plaques. There seems, on the other hand, that these two kinds of cells are very similar if not identical with each other. And we have to remember that while in the case of the spleen, we may find red corpuscles destroyed for purposes other than that of its own maintenance, we have in the case of the medulla, to deal with a tissue present histologically and chemically quite peculiar difference, it is questionable whether the blood plasma itself contains all the elements suited for its maintenance and development.

According to Petri, the white medullary tissue properly represents a kind of lymphatic or adenoid tissue, in which there are numerous vessels, or presents numerous cells somewhat of the connective
tissue type, with long branched processes, anastomosing with each other. Describe events of
transition of change between nucleated cells and corpuscles.

This description as far as 
reminds one of fetal blood development in the branched cells of the vascular area. The red
corpuscles penetrate the wall of the capillaries and are derived from the larger nucleated cell
(megakaryocyte of Robin), or from precursors cells like a process of simple fusion.

Beugnies concludes that the function of the megakaryocyte is the destruction of red blood
corpuscles, a theory quite opposed to that of Neumann.

And Fleisch concludes that in the blood of four young doves, he found the proof that the
nucleated cells of the medulla are transformed
with red blood corpuscles.

Golgi has made a series of observations upon the bone in 26 cases of hemolytic anemia and 5 cases of peculiar iron content that marked differences were observed in the bone spicula between the two forms of this disease. Hemolytic. There was diffused hemolysis in the medullary spaces (nido, bodies of Kosteow) diminution of white medullary cells and fatty degeneration of the remainder, also increase of red globule with nuclei and a scarcity of spherical cells. With regard to this one cannot conclude that he has chosen anything peculiar, as in pneumonia, there are epithelial lining of a small crust, the blood is found soon after death. The fluid fluid, with almost an absolute scarcity of red corpuscles, which shall
Later attempts to explain under
the head of Pyrexia
Postitis, he found here distinct
augmentation of white cells
of granul cells whose nuclei
were increasing by a process
of fissionation?
Here again the changes noted
are simply identical with
what one finds in general
circulating blood in cases
of septicemia. (Which under
this heading I shall later refer
Considering all the
evidence as present, at our
disposal we must admit
that the medulla of bone is
by no means yet proved
the a distinct seat of red
blood formation

Origin of red corpuscles endogenously
within connective tissue cells
As already noted in page
Schroeter has fully described such
a seat of origin, but his statements are limited to observations of such a process occurring in the spleen, bone, etc.

Origin of red corpuscles from "globules" "hematoelasts" "blood plate" & incrustable corpuscles"

There are always been seen in the blood of people enjoying perfect health, certain small elements, which have been in the past almost completely ignored, & about which there was very considerable difference of opinion first. So for the most part, principally with such bodies in the circulating blood & their homologues in pus that those most concerned themselves. They were first observed by Donné in 1838, who gave to them the name of "globules". Since his day, however, these
hoi frequently been recognized under the superinumace in each case, that they were then being described for the first time. Zimmermann called them "elementary granules" or "coagulables", while M. Hayek has applied to them the name of "hematoblasts". As far as we can see, these terms in each case apply to the same bodies, but their obscurity has decided other bodies, while many share these latter with the former. I feel that it is questionable whether or not they are quite correct in doing. Dr. Beale has assured what he considers fragments of fibrinoplasm rather than the lamina off from the pseudopodia of white corpuscles. Palmer describes what he calls "fibric corpuscles". Braggins has given the name of "blood platelets" to certain bodies.
which are considered identical with Haydon's haematoelast while under the name of
"invisible discs" Dr. Huxley lumped
for or certain bodies (?) which
he considers identical with
the haematoelasts to blood plate.

With regard to the latter, there
seems to be little doubt in the
minds of competent observers
that the so-called discs are
nothing more nor less than
destroyed red corpuscles +
certainly, if one carefully
considers the statements of the
above named writers, it will
be seen at once that from
a mere consideration of size
it is quite out of the question
to compare the invisible
discs either with the haematoelast
or blood plate.

With regard to the haematoelast
Mr. Haydon states that he does
not consider them the latter.
red or white blood corpuscles but that they are the germ of the red corpuscles. In processes of development attain to the dignity of this body, as their final stage of being. He admits that one can dose them in freshly drawn blood without the use of any reagent whatever.

He takes a clean coverglass and applies it to a slide by means of a little paste. Proceed in such a manner, as to lie between the slide and a capillary space. On applying a little blood to the side of the cover glass, using such a high power, the blood can be seen pushing in there the special elements are seen as small pale colorless corpuscles. Almost as soon as seen, they begin to change, their not points adhere to the glass, untwist up, from pale, one blood of hemoglobin.
I tend to join with each other to form a mass."

"By this time they are much changed, nearly irrecongnizable, but their presence has been ascertained. Their transformation followed. The fact made manifest that the blood contains in addition to red white corpuscles some peculiar elements, which change their appearance very rapidly." In one they are round orange from 1.5 to 3.0.

In 1882, Bizzozero sought to find what he styled a new blood corpuscle. This claim to priority was immediately opposed by R. Noirc, as already mentioned. Bizzozero stated that in the circulation, as well as in freshly drawn blood, there were little red, third elements which were pale, oval or round, disc-shaped bodies.
which measured in size, one half to one third the diameter of the red blood corpuscles.

With regard to the cause of such peculiar bodies, Mr. Pucke considers that they probably arise in some peculiar way. While Haydn makes a very interesting suggestion, to the effect that they are the endogenous product of cells still unknown. Bongard and Haydn both state that such bodies are subject to such changes, when inside the circulation. The former considers them to be the most important factor in affecting fibro formation in aneurisms or thrombi.

Coyle also, in a paper entitled "An account of certain organisms occurring in the hypodermic system," refers to them. In many diseased conditions of the body, occasionally also in perfectly
healthy individuals and in many of the lower animals, careful investigation of the blood proves that, in addition to the usual elements, there exist pale granular masses, which on closer inspection present a corpuscular appearance. . . .

. . . In some they vary frequently from half or a quarter of a white blood corpuscle, to enormous masses, occupying a large area of the field or even stretching completely across it . . . . they are seen to be pale round discs devoid of granules with well defined contours. Most probably, supposed that they arise from degeneration of white corpuscles.

Color then just as seen in normal sheep found that in all sap splenosis and chronic affections of whatever sort, they are present in considerable
numbers. He considers that they are always more numerous in the later stage of an affection, when the acute stage has been passed. He also speaks of them in health or disease, stating that he has formed up all ideas, as to their relationship to the development of red blood corpuscles. Brodie's paper refers to them. M. T. mentions them similarly to microscopie and suggests the possible origin of bacteria from them.

Oleis has formed a pretty full description of certain changes which occur in blood containing them he mixed with 1/2 or 1/4% caust solution, or fresh serum.

Hardicott says with regard to the granular matter of the blood, if a drop of blood be smeared on a slide, rapidly dried,
Stained mounted, the nuclei of the leukocytes are stained the red unstained. In addition small bodies are also seen in groups of 5-12. Estimated by means of hemacytometer, there are from 230,000 to 300,000 in a cubic millimeter. Tracy in age from 2-57-44. By allowing a drop of Hager's solution to pass under coverslip, they Jet streks. He concludes from their similarity to amoebas that they are broken up pieces of white corpuscles. Malassez states that in the condition of acute abscesses, the patient's blood is loaded with them that they are also very abundant in the condition of erysipeloid for Rheumatic fever & Pneumonia. Dandens in a clinic study of the small granular cells of
the blood, concludes, "My observations lead me to believe that the small fronds of the blood, are present in excess under two conditions 1st As a result of their excessive formation, lumped about by certain states of the blood demanding it. 2nd As a result of diminished forces in the process of charging them with hemoglobin, whereby many of them remain in their undeveloped state and do not become fully formed red cells."

Hayemi also has further observed of the hematoblast, that in the blood of animals, the corpuscles which possess a nucleus they also possess nuclei. This fact certainly of itself suggests many forcibly in reference to the Special blood that, the body mentioned
are young red corpuscles which may require charging with hemoglobin to increase in size. They are fully developed. Hayem also notes that in their behavior under the action of certain reagents, they agree with red blood corpuscles.

The preceding abstracts, which are thought proper to make, form a fairly complete review of the literature on this mysterious subject, but I have considered it advisable to interpose as little as possible by way of criticism, leaving this to be dealt with in the record of my own observation.

In commencing my studies upon the histology and formation of red and white corpuscles, I at once met with certain difficulties. These centered chiefly in the liability of red
to undergo certain peculiar changes when placed outside of the body further even if this difficulty could be surmounted a condition found for observation of this fluid under peculiar methods there still remains the fact that differentiation of structure can only be recognized, with the aid of certain staining agents, the use of which materially interferes with the structure of some at least of the corpuscles.

To avoid such corpuscular changes it is customary to make use of certain materials the application of which not only immediately kills the cells in question, but also fixes them in the condition of life of such agents, for its various and its refers to perhaps the most useful for examination of the red corpuscles, but certain
From the advantages attending its use, if one wishes afterward to make use of any staining fluid, this is the fact that the mere presence of the substance is sufficient to make proper staining an impossibility. I have therefore been compelled to abandon the use of mercuric and entirely or may add that for this somewhat similar reasons I have one after another relinquished, almost all the other freezing agents known. Lately however I have been able to make use of telluric acid of which I have succeeded in finding a suitable form of application, while giving very satisfactory results. The preliminary proceeding in each case is identical, to consist in drawing blood from the finger, by pricking it with a lance-headed needle or a tenotomy knife, taking care
To exercise no pressure on the finger either by bandage or other means. Horning in this way caused a free flow of blood, a drop is received upon a clean eyeglass and then another eyeglass is immediately superimposed upon it, as in the method of Lillich. At once by capillarity the blood extends between the glasses so as to form a new thin film, which having occurred the one over is quickly and delicately "sliced" from off the other in the way one obtains two eyeglasses each coated with a thin layer of blood. It will then be found that in a few moments each film is perfectly dry and is then ready for further use. Should however here note that in one method drying of the blood film is not permitted, the errors being at once placed in a staining fluid, consisting
If absolute alcohol, having a certain staining agent dissolved in it, passed to return to the vials from which it had been expressed which have been suspended then dried, they are then placed film side undermost in a water staining fluid. The staining fluid used may mention the following:

1. Methyl andine violet 2%
2. Diblue
3. Gentian Violet
4. Methylene Blue
5. Fuchsin
6. Saffron
7. Chrysoidin
8. Brilliant brown
9. Crome
10. Combinations, e.g. Aniline azure of either of the above.

After staining in such a fluid for periods ranging from one to five minutes, the coverglass is removed gently washed in clean water until it is seen that
all superfluous water has been removed, when it is then placed in a sloping position against a piece of wood or other support & upon a piece of clean blotting paper, & allowed there to remain until quite dry, when it is simply without any further treatment placed face downward upon a drop of Canada balsam dissolved in xylol, on a microscope slide. It is necessary to see that xylol is the solvent used for the Canada balsam, as the usual solvents, such as chloroform & dissolve the aniline stains & in this way destroy the sharp outlines, which one otherwise obtains.

In making use of an alcoholic solution of the stain, one has to make sure that the alcohol is absolutely anhydrous, if the best effect is to be obtained.

Having such an alcoholic
stain prepared, one makes
use of it for the staining of
blood or pus in the following
manner. A drop of blood
or pus is received upon a
coverslip as already directed
and then quickly superimposed.
Then they are quickly slid around
at once while still moist
immersed film side underneath
in a watch glass containing the
particular stain, which one may
wish to use. After remaining
there for a few minutes, the
coverslip is raised, gently washed
in water & subsequently placed
in end upon a piece of clean
filtering paper to drain & dry.
When completely dry each
coverslip is mounted upon
an ordinary microscope slide
by means of xylol balance.
These methods may now be
referred to by the particular names
of "water" & "alkoholic" respectively.
The Water method. — Blood stained by this method, joins many food preparations, if it be only the white corpuscles or few corpuscles that are the objects of study, but it is somewhat destructive of the red blood corpuscles, unless extreme care is taken that the film is allowed to set perfectly dry before staining. The red corpuscles in such a preparation frequently bear evidence of having just undergone a process of swelling and subsequent contraction. This not a few instances have been noticed in the process, yet withal this method is very effective in showing the gradations in size which occur among the red globules. In this way one notes that the size of the red corpuscles vary much more than at first might seem evident when one examines fresh blood.
Simply mounted unstained and dried between a coverslip slide.

The use of the alcoholic method is usually somewhat different results, which are seen to best advantage when it is focused, that happen to the stain employed. These preparations are made which compare favorably with any permanent preparations of blood which have ever yet seen. It would seem that the absolute alcohol at once fixes the albumen of the blood with its various cellular elements. By the use of the following stains, e.g., Euchem, Dahlie, Methyl Violet, Methylene blue,俾米娜克 brown, Gentian Violet, Safracon roseine (which those mentioned above never much in the order of their efficiency) a new
Evident & distinctly defining staining of the white blood corpuscles is obtained. It will be noticed that the nuclei are very deeply stained while the perinuclear protoplasm is merely tinted varying in different cells in the same preparation. From a study of such stained cells, one is able very distinctly to see that, a most characteristic division of the nuclei always obtains, that certain changes in the perinuclear protoplasm occur coincidently with the process of division of these nuclei, these may as well state that in this particular, that from the day of the white blood corpuscles applies similarly. I shall now the first instance describe all that one sees in this day + afterward show in what manner, say the use
If combined or special methods are to differentiate the various bodies, Ahmed also mentions that certain peculiarities of staining in certain cases apply to certain stains, notably methylblue. The limit to which these last are considered when planning how differentiating may best be affected will suppose that a slide prepared by the watering method. Methyl blue, is understood that the optical combinations being used is a Zeiss E 3 ocular 3 or 4. Such a combination quite very well, but I have also made use of Zeiss new apochromatic oil immersion lens of 1.30 numerical aperture. Compensated apochromatic eyepieces by which magnifying may be set varying from 300 to 2800 diameters (with drawn tube). In a slide stained as already mentioned, one
Notices that the characteristic appearance usually possessed by the red corpuscles has been lost, while they now appear as circular faintly stained bodies. The white corpuscles however stand out prominently as deeply stained bodies, not hitherto being equally stained trumpet. The nuclei are always deeply stained, while the perinuclear protoplasm is merely tinted red. It is noted that the inflorescence seen on the nuclei scales in the cell differs in various corpuscles according to their age or ripeness, but cells however which may be suspended the of the same age or development are equally stained, both as regards the nuclei or nuclei and perinuclear protoplasm. We recognize that there are
a considerable number of corpuscles possessing only one nucleus, but that of such varieties all have not an equal amount of perinuclear protoplasm. Some have a relatively large nucleus and many little protoplasm surrounding them, as much as that in some cases it is not difficult to see the protoplasm at all, while others are plentifully supplied with it, making up four fifths of the corpuscles seen. While the nucleus of the first is always very deeply stained, that of the second is always less so. The first corpuscle in eye is always slightly smaller than the red corpuscles, but there distinct foldation in eye is by that of the second as that we are almost
Justified in considering the second as a cell which previously existed in the same condition as the first. Another kind of cell which claims our attention is one which usually also possesses considerable perinuclear paraplasm and a single peculiar nucleus. The peculiarity of this latter consists in its size, form, and staining characteristics. In form it approaches a horseshoe shape and if fully thick usually is slightly stained. Stained nuclei of thinness and more compact looking it is densely stained. Among such horse shoe shaped nuclei are the recognized those which show a distinct constriction at the junction of the two halves of the shoe, and are usually so densely stained as the thinner complete...
ones already mentioned. Such a cell forcibly suggests that in the nucleus a process of disintegration is about to take place to such a member emphasis by our observing similar cells with similar nuclei, whose however are already divided, in which the line of disintegration corresponds directly with that in those previously noticed. We further then observe such cells possessing two long nuclei with rounded ends one can recognize that in many one of the contained nuclei where a contracted hour-glass shape, suggesting further disintegration then at a point which would correspond in the complete hour-glass shaped nucleus with the junction of the outer fourth with the rest or again then to emphasized
by our finding numerous cells possessing one long nucleus or two shorter ones. In some cases it would appear, from fossils which will be afterwards stated, that the process of denudation stops here, that the denuded nuclei slightly alter their shape so as to become quite or nearly fuse, spherical. But it is evident that such is not the rule, as we can observe cells in which the remaining half of the pole, i.e., the third undenuded nucleus, becomes constructed at its centre just as we assume the other (now the two smaller nuclei) to have done. One can infer from the presence of other cells having four nuclei arranged in such a manner that denumini normally proceed in this fashion. But while this suggest that the formation
by successive division, if four nuclei is the rule formed, submit that many divisions occur as in some cases it is possible to get five, or six, nuclei contained in one cell. Now while paying such attention to the nuclei, it is also requisite that we consider the changes proceeding in the cell itself. One thus have to note that while we can easily observe the presence of distinctly marked perinuclear protoplasm in the unicellular protoplasm the same does not equally apply to the bi- and quadrinuclear cells. We will be able by careful observation to note that the protoplasm seems to set up a protective layer as division of the nucleus advances, turned thus aspact is no that it is
either undergoing gradual degeneration or being absorbed by the decaying nuclei.
Of these two alternatives I must rather accept the latter. Of degenerations taking
place in such juxtaposition that of a fatty kind, consisting in the formation of
distinct oil globules in the interst is key for the most common and almost so far
as I have been able to learn from observation, takes the lead in others. Such a
change is always most easily distinguished, and I have uniformly failed to
notice it here. When the nuclei have become completely decided and
have further assumed the spherical form, as a rule as first shown in the
made out of Men as Cell

*Thus to common in pus aches in assorted blood
wall. In this way then they gradually progressing change and obtain nuclei set free in the blood stream. Is what end does this lead?

Constitution of the nucleus

As seen in preparations stained by means of Methylene Blue, we note that the nuclei are enclosed in a distinct nuclear membrane that the latter enclosed substance is made up of a colourable or Chromatic substance and comparatively uncolourable or Achromatic substance. The appearance thus presented may be graphically represented by placing a number of white balls in a bag made of a blue-coloured netting. From an examination of nuclei stained in various ways I have no hesitation in affirming

* This refers that the protoplasm cease call the gradually disappeared.
that there is invariably present a well marked intranuclear network or meshwork of that this network is composed of a chromatic material the chromatin of writing but with regard to the nuclear substance it is somewhat difficult to correctly define it. As far as I am aware very little has been made up with reference to the constitution of the nuclei of the white corpuscles, but with regard to those of the cells much valuable information has been collected for these are greatly indebted to the researches of Flemming, Strümpell, and Heidenhain. Many consider that the nuclear substance is of a fluid nature, which does indeed seem to be of a plastic nature.
Restricting my observations for the present to the nuclei of the white corpuscles, I have observed that the nuclear material is of a plastic or semi-liquid nature, of granular in character. Further statements will be better defined until a
suitable method of observation has been described.
In addition then to the cells described of possessing nuclei easily differentiable from the perinuclear protoplasm, we find others some of which are of large size the largest nucleated white corpuscles but differ markedly from them, in that no nuclei are discernible & from the fact that the whole cell stains uniformly deeply & approaches in this way to the characteristics of 3-nucleolus. Further from
most of these bodies have a faint narrow band deeply stained round the perinuclear region which may be first plumulae. Nature will be later explained.
The fact that nuclear bodies can be observed which vary in size from that of a daughter nucleus produced by the process of division previously described, it is possible to think perhaps to consider such cells as developmental forms successive to the smaller divided nuclei which have become liberated, by absorption of perinuclear protoplasm, thus set free as already pointed out in the circulating blood. Indeed one has it considered that all the liberated nuclei pass onward by progressive enlargement. Such a state, it is rather probable that some of them may become in a resting form for some time states by an accretion of perinuclear protoplasm, start onward as young
white connective. Thus then those indicated that a young white unicellular connective develops by gradual transition and finally into a multinucleated cell, but that in the terminal stage, its further development may take one of two courses, either becoming again as the nuclei set free become in their turn white connective, or they simply undergo gradual enlargement arising latterly at the stage already described. What then are the functions of any of such a body? What is its potentiality? Before attempting a solution of this problem I shall pass to consider the bodies known as blood platelets or hematoblasts to which also refer the name.
apply. There already in a
premiso form of the paper
referred to them. In slides
prepared in the way we have
been considering, the blood
plate are beautifully seen.
They stain more deeply
than the red corpuscles, but
much less so than the
nuclei of the white corpuscles.

I may at once state
that a very careful observer
may quickly note that they
are certainly not liberated
nuclei of white corpuscles
from the foot, firstly, that
they are too small and
secondly from their staining
is rather want of staining
perspectives. In such prepa-
ration it is difficult to
make out a distinct cell
wall but every 15 to 20
by the use of other methods
They are The seen under
certain constitutional conditions bring great advantage.
1. In the stage of emaciation from chronic febrile diseases such as scarlet fever, dyspepsia, and the septicaemia disease.
2. Shortly after a full meal but best after a meal which comes at the end of a period of great mental or bodily labor.

It is to be noticed that, while they may be distributed all over the body, they are in certain places massed together in a more or less spherical clumps, strongly suggesting that they have previously been enclosed within a definite restricting membrane or case. They are diminished in members, during the acute stage of suppuration or sepsis.
During the period preceding a
meat filling a foot
They are sometimes demonstrated
among the early persons of
functional anemia.

Their color is stained porphyric
varies with wide limits.
As a rule, the orange color in
such preparations is about
the one fifth of the diameter
of a red corpuscle of orange
color; but all gradations may
be observed up to that of a
small red corpuscle.

Examined thus, they strongly
suggest the idea, that they
are young forms of red blood
corpuscles, but as well he seen.
Later, these methods render this
almost a certainty.

Hence As they came?

These already indicated
the views held with regard
to them. Those emphasized
the views of Mr. Harvey.

* Normally they are present in conditions where the
white corpuscles are at their maximum, in small
numbers, in diverse.
For a considerable time I have held the belief firmly, purely theoretical, founded &
clutted as a result of certain observations, that they were
the endothelial product of these peculiar large nuclear-
like cells already described.

Not having one by macroscopic
examination I was enabled
directly to affirm that

...One preparation
in my possession alone
so different I think to
convince the most sceptical
as the blood plate may
be seen in process of
...it from the cell. With regard
This particular cell knows
one thing has greatly puzzled
me that only myself
but several others, namely
in that there may be seen
at me start of it a darkly
stained body, whose presence I could not satisfactorily explain. This difficulty I had overcome and will explain it later when describing the dating method of staining. Remaining in fluid media.

Experiments show that the blood plate are produced from the interior of certain white cells.

As it might be considered that the blood plate were artificial productions due to the pressure exerted by the two coverglasses upon the film of blood, in making these preparations, I had recourse to this method. After cleaning the material, it was well fixed by a lance-headed needle in a drop receiving it was made to approach a coverglass, in such a way that only the very surface
The drop touched it, while the paper itself did not at all come in contact with it. By moving the paper about it was easy to get a large surface of the coverglass touched with the blood, in this way no pressure whatever was brought to bear upon the elements of the blood at all. This coverglass was prepared one after the other, in this way one was then dried. Dried while the other was at once laid in a shallow glass cell in which was present a piece of damp blotting paper & sealed up with vaseline after which it was placed in the incubator for 24 hours at a constant temperature of 33° Centigrade. In this experiment the coverglass just coated was the one dried
while the second me rescued was the me incubated. In case known that it might be hekth that a difference existed in the kold taken in the two cases, a second agreement was made to embft the first, the conditions being reversed, while the that is 4 day in this case the first emulsion made was the me incubated of the second simply dried stained. In the case of these incubated they were at the end of the period of incubation stained just as those simply dried were. As aremet of this it was found that in the slide simply dried stained few blood plate were visible, while in those which had been incubated tremendous numbers were. The found lying in heaps while near
them were to be found the
empty cells from which they
had issued. This experiment
most forcibly in character
carries conviction with it
thus the origin of the
blood plate is plann.
In such an experiment
I never another fact is
The learned that is that
the blood plate are capable
of growth for a time after
being set free outside the
circulation. This is seen
in Photographic
Putting acide hianso, for the
moment the junction of the
site & mode of origin of these
blood plate, let us enquire
in what direction their junction
tends, supposing also for the
time that the idea of this
linear group forms upon
spheres is not proved.
It has been stated by Bizzopo
that they are not merely the initiators but the actual cause of fibrin formation. The further holds that the production of thrombi and emboli are due to them. If such be the case, then in a film of blood, kept from drying and allowed to coagulate, we should find that the fibrin filaments should take their origin from them. In order to test this, I have performed the following experiment many times. A drop of blood is drawn from the finger and allowed (the drop on the finger) to touch a compress and made to spread over it in the way previously described without the presence of any preservative being allowed, when it is then placed in a simple flask cell in which a piece of moist thin lens paper
also placed, when the
cover is firmly put on the-


I should say as a result of my observations that it is the white corpuscles we are indebted for fibrin formation, but that for coagulation the red corpuscles supply the presence of the white to initiate the change. I named suggest most emphatically that in coagulation we have two kinds of change viz. a change in the white corpuscles themselves forming us as a result firm & a change in the red corpuscles dependent however upon the preceding change in the white forming up coagulation. I believe that as regards the white corpuscles, their firm formation may be looked upon as a necrobiosis due not so much to extravascular environment as to contact with foreign substance.
I had only a few days ago a very good opportunity of this, when making a post mortem examination of a rabbit. On this occasion I had removed the heart and great vessels placed them upon a glass plate, prepared to remove the former. I then transfused the heart a quantity of blood about two thirds of the whole, escaped and collected around the organ, upon the glass plate, formed within the minute a firm coagulum, while in the contrary, the blood still in the cavity of the heart remained liquid and microscopically unchanged for three quarters of an hour. If one & another incubated preparations made upon these glasses, it will be found that commence nigreti
formation so always indicated in the multinucleated while enucleate, first, most in the bimembranous state in the unimembranous enucleate, while those cells which those indicated as being blood cells to which I named suggest the name of Matrbcyte. The form, seem to be unaffected entirely. This may be proved in another way. Some place a drop of blood upon a slide & allow a cover glass fall upon it, the blood will spread by capillarity to the edge of the free lump of blood present & will in the latter situation soon dry & thus fix the cover firmly upon the slide. Upon examining it microscopically at the end of twenty-four hours one will find the peripheral portion fused into an almost
irreparably mass, while the central portions may be yet as for as one can see by examination normal. If however a portion be collected in which coagulation has become complete, they will note that the cells of the mature type stand out from among the other elongated surrounding as distinct spherical non-nucleated white bodies. My reason for holding that fibrous formation is due to the white multinucleated nucleated corpuscles, are based upon such observation the following.

In the blood of a cat killed four taken on the third day, one can find few or none of the blood platelets, but eminently tremendous numbers of multinucleated white blood corpuscles, sometimes formed
together in large masses if twenty or persons. Such blood is found to coagulate with surprising rapidity, so much so, that in my observations on socalled blood, I had no cause to cultivate from selenite to circulate the blood into selenite at the bedside of the patient therefor immediately to apply the jelly by moist heat or then by shaking, mix the blood with it. Therefor we find that blood containing erythrocytes, white corpuscles, and few blood plate, for it leads to the formation of much fibrin. Further I shall have to point out at a later period that fever itself drawn from an acute abscess, in which red blood is present what point, even when the abscessic
test is applied, a drop of
anemia us induces firm
formation, thus proving that
red blood corpuscles are
not entirely necessary for
this change.

Horming then detailed the changes
obtaining in the white corpuscles,
which are the seen in dried
preparations, it will be well
before proceeding further, to
take a critical retrospect
meic, in order to avoid certain
failures.

Of one of alman's plate III, they
will see a semidiaparametric
scheme of these changes, beginning
with a binucleate white corpuscle
in which the perinucleus persists
is quite evident, from this point
onward, the other changes proceed
progress, with a coincident
gradual diminution of the
perinucleus persists, suggesting
his the idea that it is used
up in forming nutrient of the forming nuclei, until in f2.10 we find the nuclei set free. At this point we meet with what is evidently the "next point" in the process. What becomes of these liberated nuclei? There is no doubt whatever but that they then pass into the "stage, seen in fig. 11, in which extremely little permicellular protoplasm is the seen. Such bodies (fig. 11) have from me a very great deal of trouble, because in many cases the permicellular protoplasm is so small in amount & so readily stained that it is difficult to detect it. This will be at once understood when it is considered that the wood cells designated by me matricyle, must, if derived from the white corpuscles, take origin from this stage. But again it is reasonable to conclude that (fig. 11) these bodies are just white corpuscles of a young type which will not
pass & the stage seem to be that I have come to show that proliferation of white blood corpuscles takes place in the general circulation. I must confess that I also believe that from white corpuscles blood cells are formed which by endothelium division yield the blood plate which later become possessed of hemoglobin & take upon themselves the rôle of red corpuscles. Hence then do the blood cells arise & what are their characteristics? Of me I am acquainted, & if in plate they will see a blood cell figures in the act of also changing to blood, they will notice that both the cell & its contents are not deeply stained. That further a small deeply stained point & nep in the ruptured cell, here
again a difficulty assails us, in that from what has already been shown, we should expect a blood cell to be stained faintly deeply all over. If they do not thus stain, it follows that they are rarely present in blood, or are almost always destroyed by the method used. Further we always notice that the blood plate seen in stained preparations are not deeply stained, whence if the cell containing them, in its intact condition takes on a deep colour, it follows that this characteristic reaction must rest with the cell envelope. Thence even if such cells were destroyed, the empty envelope always lie easily found among determinations from my observations, that blood cells were present in the blood, led myself to the problem of finding
out their morphological characteristics when intact.

In the course of my investigations I found it almost hopeless to solve the problem, when working with dried blood. Accordingly I began experimenting with blood undried. Returning mounted in fluids, it will be quite superfluous for me to detail the numerous experiments I made, before I arrived at a successful method, but will only state that I was successful, for beyond what my anticipation led me to think I could see the method I was using, the merest types in histological research will be able to demonstrate the blood cells and also the whole chain of karyokinetic processes which lead up to their formation.
The methods which I am now about to describe have been completely successful in my hands in affording me ample demonstration of certain changes occurring in the blood, completing the peculiar change in white corpuscles. The history of the white blood corpuscles understood.

A solution of Aniline Dihydroxy is made in water of the strength of 3% to which 30% of absolute alcohol is added. After repeated filtration, the solution is diluted with ordinary water to a strength of 1% strength. Finally, 10% of a 2% solution is filtered. In order to use this solution, which I have selected out of a large number of experimental solutions, a drop of blood is drawn from the patient without pressure, is placed on a clean slide, and which a drop of the Anine Dihydroxy is placed and then filtered with the means of a mounted needle.
When mixed, a corrosive is at once applied, these I may state that if the correct quantity has been taken it will just spread completely between every plate, leaving many little fuses inside the explosion it at once sealed by passing Canada balsam all round the periphery.

On examination it was found that all the red enflames have suffered transmutation of their contained homogenates appear as clear fluidal bodies which have percolated their way round the presence of the little bud which has been described by Roberts and others, but which present concerns us little. Of the white enflames it is noticed at this stage only now, that there are evidently two kinds of unicellular enflames. One kind has a pummeled periphery...
which forms a ragged fringe around it, while the nucleus stains deeply of a purple grape colour. The nucleus in this case is always slightly smaller than the red corpuscles present.

The other kind has a more delicate perinuclear part, placed contrasting with the granular kind in the preceding. The cell wall is well defined and not ragged in outline. The nucleus here is altogether different, being always larger, retaining a blue colour and not staining deeply. This kind of unnucler corpuscle is the blood cell.

I shall describe presently how the blood is taken. In both kinds of nucleus there is clearly demonstrable an endonucleus or often an accessory one. This is I believe the first time that such a body has been described.
made out, that it will be
fairly certain at once accepted
as being universally present.
The multinuclear emperors
do not take up the plan
for some little time longer
while doing so one can observe
that they are of the same kind
as the small, peculiar, 
unique variety. If only one extra-nu-
clear be present in the peculiar kind,
it remains evidently unchanged
until the assumption of the
horseshoe shape has been
completed, but when descent
is about to occur it disappears
reappearing in humani when the
bimuclear form is completed.
Then it is seen that an intra-
nuclear is present in each
half, the same thing occurs
in further descent into four
taking place but it is much more difficult
to demonstrate it.
This is part of the Trypsinotic change which take place in the white blood corpuscle and is of the example of "Audreaa" division in the platina nucleus one can easily make out by staining with Methylene Blue, what is known Tieded by Fleming the "Homocurali Stage," further when division into two is taking place, stage I (Fleming) is also clearly demonstrated, but the other stage, stage II is not yet clearly ascertained. However what has been here indicated is indeed a considerable advance in our knowledge of this peculiar corpuscle. There is most clearly that we can no longer conclude that division of the nucleus of the white corpuscle is an instance of degeneration (Hamilton Pathology, 1889, Vol I p. 477) (In this volume of Pathology is included most
Of what is known upon this subject, down (in the most recent papers).

Will show when discussing "Oot' wherein the cells were found together with those from an inflamed area differ from certain of the white corpuscles or the blue unincellular cell which I have already stated blue a blood cell; there may here be included in the nucleus a number of spherical or irregularly spherical bodies which at this stage are seen in the nuclei tinged with the stain. While scanning such a slide had a most beautiful demonstration of the manner in which the blood platelets are strided in the blood cell. The first change in this case consisted in a distension of the capsule of the cell with fluid.
dry osmotic change & then the membrane of the so-called in the case, nucleus ruptured so that now the blood was free in the cell. Following this they began to emerge from the cell itself, which however strangely retained its form for the while. I do not suppose that this is the normal manner of emergence but it afforded proof of the manner in which the blood plate arose. Now if one examined such a preparation as I have described one sees the endonuclear, they will have no difficulty in understanding the meaning of the dark spot seen in a permanent preparation of a blood cell rupturing which there in my processes of which an illustration is shown in Fig 29 Plate II Fig 24 Plate XI.
In order however to control these experiments I have made use of another method which gives many good results. The No. 22 lemon is pleasantly described to diluted without the addition of almost to one tenth its strength with "hydrosol fluid" repeatedly filtered. The blood is then mixed in the same way with this fluid, one finds that the red corpuscles remain pretty much unaltered for nearly eight hours and even twenty four hours later many may be seen of normal form. At the end of twenty four hours however about half the red corpuscles have become completely destroyed. The white corpuscles do not stain as well by this method but sufficiently to enable me to make out the change.
which Thane described. Particularly the blood plate in the blood cells. Here also we find unmistakable evidence that the blood plate are young red blood corpuscles, as in clumps which are faintly stained we may discern several which are already in process of acquiring them. By the pressure method one may see that the blood plate are really cells possessing a definite cell wall and protoplasm which becomes at this stage stains somewhat different from the red corpuscles which only get their capers. The blood like body stained in the blood plate we see certain change occurring just as in the case of the red blood corpuscles one finds that the centric change causes destruction of the Little
cell which thus loses its attachment to the basement which then occurs on a regular plan & takes on the same as that we have thus explained to us the appearance of the blood plate in dried preparations. In the process of staining a film on a coverslip the blood plate will swell up & become dispersed. Thus the stained little bodies left are the footplacenta remains only of small presistent cells.

From such a consideration it necessarily follows that we should see the blood plate in normal blood, if we use a good enough optical combination & attend to the lighting of the object. And it must
easily now be discern in healthy blood considerable
numbers of blood plate which appear as small unstained cells varying in size from 17 to 37 and some have colored envelopes from the age of 30 upward it is quite clear that the smaller unstained cells are the transitional forms of the larger colored ones. The optical examination best suited for such examination is a grassachromatic oil immersion 1:30 ap. 2 mm. frosted distance with Genesis of the compensation series. With this the use of a hot air lamp having a blue glass chimney, what have just described may be clearly made out of me keeps the microscope somewhat inclined. The fest blood under a compound sealed with Canada balsam...
peculiarites may be seen in the white corpuscles. When the nose is moderately clammy, the white corpuscles may show an unusual amount it will be noticed that the granules of the pus corpuscles take on a very slight brownish movement, while many escape altogether to dance away over the field. It is such granules that I consider conglomeration to be true, they acting as the ferment.

It may be well seen by the two former methods as well as by this that there are two varieties of granules: coarse granular and a coarse granular. Of the latter we find that the granules stain with various aniline stains and particularly eosin stains included in a white corpuscle and I do not at all doubt...
that they have frequently been mistaken for such. 
Resume of what has been stated regarding the white blood 
corpuscles; 
1st. Three kinds are thus distinguished in human blood- 
(a) Large unincrusted corpuscles with a very small amount of 
hemoglobin, or nearly so, peri-
nuclear protoplasm. These are 
the blood cells or Matueytes; 
(b) Finely granular corpuscles 
with from one to five nuclei 
and exceptional cases, as many 
as seven; 
(c) Coarsely granular corpuscles—
which must usually contain more than two nuclei or not 
more than five. The granules 
stain readily with aniline dyes; in preparations either of 
dried blood, or in those 
mounted directly in a weak 
retaining fluid.
Life history of the white blood corpuscles & blood platelets. The small uninuclear corpuscle (that kind which stains at once of a deep claret color when blood is mixed with a weak solution of aniline aldehyde stain), at first seen to possess a well-defined nucleus, within which there is easily seen an endonucleus, placed usually somewhat eccentrically. Somewhat enlargement of cell nucleus occurs, the latter assuming a definite horseshoe-like form. Up to this time the endonucleus remains, so far as can be seen, unchanged usually, but in some cases it accompanied by a second similar body, which either has been produced by direct division of the first or to another endonucleus, or to an accessory one similar to what Fleming has described.
Somewhat later division is seen to take place in the nucleus, at the site of the middle of the horseshoe and the endonuclear mass is entirely lost sight of, but reappears in the form of two such similar bodies situated, one in each daughter nucleus. From this time onwards, division proceeds in each of the daughter nuclei and the endonuclear always disappears immediately previous to reappearance after the division has been accomplished. As the process goes on, one can note by the observation of dried stained blood that the daughters get paler, as if being used up for the nutrition of the forming nuclei. Lastly, we note that the daughter nuclei are actually set free in the blood stream. The free nuclei may gather around them a small amount of peric-
nuclear postnuclear & begin life either as young white blood corpuscles, or as young metocytes. If as the former, then their life history has been already detailed if as the latter, the postnuclear is seen soon to be enclosed in a definite capsule or cell, much more clearly defined than in the case of the young white blood corpuscles, but the postnuclear remains small in amount. The nuclear soon enlarges assuming a regularly cord form & the nuclear membrane is clearly defined as is also the deeply stainable endonucleus. We notice, that very soon the nuclear matrix change so that it is not easily stained by the usual dyes & begin to 15 get broken up into a collection of spherical bodies which stain less easily than the nuclear membrane.
During this process we note that the endomembrane does not suffer division, but remains whole as long as seen. When the contained blood amoebae at maturity the nuclear membranes rupture, liberating the blood platelets so that they are contained within the capsule of the cell itself. Later this capsule is ruptured and the blood platelets become set free in the circulation. After a time these young blood platelets attain a size of 2 by when they begin to acquire hemoglobin, becoming somewhat ellipsoidal or discoidal. They then are young red blood corpuscles.

It should be noted that in all cases the blood cell stage does not start from the unilocular corpuscles, but the change may be initiated while the nuclei are yet included in a multinucleate white corpuscle.
Having thus seen that white blood corpuscles can also proliferate while in the general circulation with the result of producing young white blood corpuscles & young red blood corpuscles, we may leave the latter for the present & consider in what way the former normally in a pathologic state are of direct interest. The paper Bacterial Leucocytosis.

Previously we noted that the number of white blood corpuscles present in the circulation, is subject to several daily change, as after feeding. One are well aware from the works of Ruphi Bennett & others that in the disease known as Leucocytosis there is an absolute increase in their numbers, with a corresponding decrease in the red blood corpuscles. The same applies also to certain other
across, which are not at all events necessarily due to bacterial infection. It then goes to consider analogous change associated with the presence of bacteria in the blood.

Numerous observers have noted that the white corpuscles are distinctly augmented in number in the blood of patients presenting abscess formation. They add that in the evacuation of the pus, the leucocytes pass away. This therefore is a clinical fact to propose attempting to explain it.

While engaged with an investigation into the nature of the eruption of Scarlet Fever, I noticed that during the early days of the fever, while the temperature was yet high and rising, that the blood contained tremendous quantities of white corpuscles.
So much so, that in preparing stained endosteal preparations, instead of seeing one or two or none in a field, there were great numbers & often crowded together in quantities of 10-30. Immediately knew that the appearance of the temperature began to indicate a rapid fall in the numbers of the white corpuscles was arrested whereas in the former case none or few blood plate were observed in the later condition these began to appear, latterly being present in excessive quantities & with this formation began the true stage of convalescence: blood regeneration. In these cases however occurring in persons of a low state of health, it was usual to find microscopically remaining in the blood for a considerable time, from a week
To a fortunate such case almost invariably made a shabby recovery, leaving hospital at the end of six weeks or longer in a distinctly improved condition. This for a running course terminating normally in recovery from the severe acute paratyphoid fever. In a typical case of septicaemia following an operation for excision of the mamma, there is also to be seen the Paris condition of the leucocytes & leucocytosis to discover what the cause was, whether it lay in the fact of their being pyogenic material in the nature of pyogenic circulations in the blood, or whether it was due to the presence therein of micro-organisms.

And that as a result of inoculating rabbits or monkeys...
with certain cultivations of Bacillus that true invariably follows a well-marked increase in the number of the white corpuscles.

To produce this condition of bacterial hemocytotoxie, it is not necessary that the cultivation used be that of an organism pathogenic to the species of animal inoculated. Bacillus anthracis is non-pathogenic to rabbits, yet the injection put out anemia of a culture of it is followed in certain twenty-four hours by a decided hemocytotoxie, which terminates with the disappearance from the blood of the bacillus. But it happens that with certain bacteria which I have lately been working with that this hemocytotoxie lasts for a week I have not been able to detect the presence of the organism in the blood nor to obtain cultures from it either. In this case
there has appeared in from 5 to 7 days an abscess in both rabbits inoculated in the paws and in mice. In mice, no pus was detected, while however in more severe cases no reed material for cultivation. Closely managed for pure cultures, the explanation of this possibly lies in the fact that the special action in question may produce 5 per cent. pus results which enter the circulation, where disease is rapidly stimulated and the white blood corpuscles. This experiment is, case of Erysipelas is directly analogous to a case which occurred lately in Peking. Chinesen were found after cream of the manna, epithelium developed, and made during its progress a large number of microscopical specimens which were microscopically examined, but I did not observe in any one case bacteria present.
There was a tremendous increase in the white corpuscles herein & the urine determined upon attempting cultivation experiments. These were made by inoculating quantities of sterilized 1-53 drops into tubes of torpedo jelly & these in incubation in every case showed the presence of the same bacteria. Indeed the pressure emphasizes the fact that must respec & examination of blood serum is not the relied upon alone as a test for the presence or absence of bacteria for the fluids in question. There is therefore no doubt always the found clinically a decided leucopenia, when microphages have entered the system & I have always found that in such cases there is a plethora of blood plate present hence coinciding in the light from my own
observations, whenever the spleen becomes impacted with blood and an anemia. Temper without duration is rare. If present, the fever found in malarial remittent fevers is that during the period when the recovery lasts was most marked, the white corpuscles were almost all multinucleated reticulated. If the spleen is large, the blood condition, there is an inhibition of blood-forming functions. Thus, in blood destruction in such cases is increased, so tissue change is not normal, the anemia is explainable. We further learn from clinical observation that in the anemia of the late stages of malarial disease, the administration of iron is most usually attended with the best results, the red corpuscles not only
becoming increased in numbers, but losing in addition their homogamy for corporeal augmented hence it seemed he of interest to kni whether this increase is due to the mere presence of iron affecting the erythros or to an anthropogenic effect exerted on the microorganisms. It is possible that it acts both ways. In Professor Chevi's words there was lately a just who had suffered from a very severe burn on the hip + buttock, all sorts of treatments for a time were unavailing in setting the large ulcer found covered with epithelium. Dr. Temple suggested the home remedy of large doses of iron, which he adopted with the result that "the epithelium grew over at such a rate that you almost could imagine you"
...Raw it... As a matter of fact within eight days from the commencement of the administration... The tumour, the large ulcer measuring fully six inches in length by four inches in diameter was healed over... Noting then that the white blood corpuscles became very largely increased while still within the circulatory system under the action of microorganisms, we have... Consider that white corpuscles react 15 microorganisms when situated within the general circulation... Before entering upon the consideration of this question it will be necessary to inquire into the nature of those microorganisms...
In no department of medical science are we more likely to obtain useful and special subject than we do when this subject is under consideration. We may inquire into a considerable number of books and in some, that one clear definition is found or that another is not at all agree with that found elsewhere. In Cooper's Surgical Dictionary a passage occurs which reads:

"The preceding edition of the Dictionary in 1838, has been that school of pathology, which, founded on microscopic examination, which has been enabled by this instrument to penetrate further into the secrets of nature than was thought possible by the"
Illustrations may have been used about the cell theory, with its applications and modifications by the Goodric, Hupre, Bennett, Lebert, Virchow, Male.

The arteries instead of being considered the true seat of all living operators, as in Hunter's time, are no longer merely as pulmonary and distributors of blood, whilst the real tissue, the extravascular or intravascular, as they were at first called, are seen to be the real seat of suppuration, as of the pathological charge.

The process of pseudoformation on the contrary is declared the one most of all.

Or decay, but of active forms, & put the one of a set Mordwib, whose vitality is for too great.

At the time when this was written, Clendrin Schaffhaeuser had each tried to show that purpurae were derived from a transformation of
Red blood corpuscles, however, show only a very slight change in color, as the result of this remarkable change in the body. On this point, in the same way, it has been seen that various theories emanating from the side of the blood corpuscles have been in vogue for a time, but the later discarded while later again revived. It is easy to see that all theorems pertaining to corpuscles must necessarily remain in a condition of "unstable equilibrium" until something more definite is known with regard to the histology of the red corpuscles of normal blood. At the present moment we find mucous glands undeterred as to the histology even of the white cells. This fluid is said to differ from ordinary lymph by "its" deprivation of the white cells found in it.
The same authority states that it does not contain fibres, and that it does not spontaneously coagulate. This whole statement is absolutely erroneous. Liquefiable pus always undergoes spontaneous coagulation, but it does not form a mass such as we get in blood for the example passes that red cells are absent. Further, pus can always be obtained but small in amount, and directly in accordance with the age of the pus in question. It is not surprising to find it in pus derived from a tubercular abscess, but such pus cannot be considered as liquefiable pus.

"The essential constituents of pus are cells. The liquid (liquor pusis) in which they are suspended." (Pate) "It consists purely of liquid plasma, small leucocytes, containing from
one or three nuclei, or called "nuclei" or "nucleus" (Steinacher pathology). "A pus cell is found to contain a double or triple nucleus. This breaking up of the nucleus is not to be looked upon as a sign of active growth, but rather as a degenerative state of change" (Neches' Ann.).

In a previous essay I pointed out that pus cells commonly contained 5 or 6 nuclei, and many cases that they contained 7 or 8 at that time. I believed my statement then something new, however it is not so new as we find in Hamilton's pathology Vol. 1. 1879. That a pus cell is a body about the size of a leucocyte or larger, containing from one to 24 nuclei, or more. More or less fatty.

C. F. Restatement.

Röhnheim's restatement. Nähr's description of the migration of white blood corpuscle, etc. once held as accounting for...
preformation in this way the theory formerly held that pre- was the product. The proliferation of tissue elements acting under the influence of the inflammatory stimulus was put in the background. Now a day's research there has been an attempt made to assimilate these two theories by admitting that both may play important part in preformation. I do not intend in this essay to detail any experimental observations in support in the way that has been to me time as wej experiments upon the cornea or but I shall the forms and peculiarities of the body me finds me various preformative conditions in various situations it these show that such observation may be clinically useful in forming disputes.
In opposition to the theory that pus is formed solely from migrating white blood corpuscles, I propose the following practical statement.

The total quantity of blood in the human body may be estimated at about 1/4 the total body weight. A man then of 11 stone weight will possess 11 lbs. of fluid blood. In blood we find that the white corpuscles are present in the proportion of 1 in 500 red corpuscles. Therefore we assume that we can divide the blood into two kinds, white and red. If the white is equal to one-fifth of the total blood we find roughly that the white blood will only amount to 5/500 of the total blood present. Thus

\[ 11 \text{ lbs} \times 16 \times \frac{1}{500} = 77,000 \text{ fluid ounces} \]

Or in terms of white = \( \frac{1}{500} \times 77,000 \)

= 154 ounces

Thus the total white blood is
man receiving 110 stones will amount to 134 pounds less, or nearly two-thirds of a pound. It was formed at a very rapid rate, as for instance in a case which has come under my observation, it was formed at the rate of something between 20 to 40 ounces in 24 hours. Could the white blood corpuscles account for this? It is evident that this theory will not hold. Therefore we are forced to fall back upon the justification theory. May I not add that the discovery by Dr. Pocklington, of migrating connective tissue corpuscles, would lead to a theory that these formation corpuscles be accounted for. But this, if itself implies a necessity for proliferation of these latter cells, it is then difficult to see why they should not proliferate directly in the
scuppative area.

Putting aside then for the moment all idea that migration of white corpuscles alone, can be the true cause of new formation, we have to consider the question of justification of it against the theory of multiplication. Then is up to the present no certain knowledge that white blood corpuscles derive at all even in the circulation.

Hamilton says the opposed leucocytes disintegrate after having passed the wall of the vessel? An affirmative answer is this usual statement.

Impressed, there seems some ground for believing, however, from later researches, that, if properly nourished, they may divide. Thus add the mass of accumulated opinion. I see no reason to doubt that the multiple nuclei of new cells are simply the result of disintegration. Nothing has been observed to indicate that division of the nucleus is followed by a division of the cell.
Known of their further development.

Siewer's Pseudomy. II. p. 150

Somewhat similar means are put forward by numerous other observers as Kottcher, Hesse, Bannikow, and others.

In forms of proliferation

Godec and Redfemi lose each described an excessive proliferation, taking place in cartilage cells, in such a way that the cell broods formed resembled very closely year corselets.

Korschke describes it as taking place first in connective tissue of a figure eight as seen in the subcutaneous tissue of a rabbit wound about a ligature. Recently from Speculum

Beyler by means of his celebrated experiments arrived at results which tended to show that in cells which migrated into a space formed by two enucleuses a certain well defined proliferation...
to the place the pro a figure of the cells seen M l p 137.
As a result of placing certain dead tissues into the abdominal cavity of animals, such as a piece of hardened lump, other organs, fragments of organs, red pulp, spleen, lymph nodes, lymph nodes, other, concluded that proliferation of the cells took place which had migrated into them.

Is it therefore clear that if it can be clearly proved that a definite proliferation of white blood corpuscles takes place within the blood vessels, it may be inferred that a circumscribed proliferation may take place outside them also. If the conditions of environment be satisfactory, in the new situation of reticulosis, the blood corpuscles thus formed may be examined by the method already specified for the white
blood corpuscles, it will be seen that all conditions of cells will be found from the single unicellular cell up to that of cells containing as many as seven nuclei. Further, it will be noted that the beautifully regular method of division which obtains in blood within the general circulation is here interfered with so that irregular forms of division of the nucleus obtains. If the "wetty method" is used it will be seen that the unicellular cells of the kind which have denominated as blood cells are for the most part conceptions by their absence, and if one or two are found after perceiving 20 or 30 fields, we cannot be certain that they have not been obtained from the blood. Nonetheless, however, he noted
that bodies somewhat similar to red blood cells are frequently present in considerable numbers. I should try to show presently that there are really blood platelets which are their presence is the falling in of the tissue enclosing them, at the suppurative area. Surrounding tissue abscess cavity is suppurative area to a zone of inflammatory tissue and the tension of the abscess area is affected by an undermining of the wall by discrete free, pus-filled cavities. These cavities become confluent. See photo 41 Plate XVL

In this compacted area, we must hold if my statements are to be considered correct, blood is being formed. Hence if this tissue becomes mixed up with the pus, the yellow blood platelets will be present. The presence in this way of such
forms in this, so indicative of extending peri-formation.
Professor平面 lately having been a cubical bone, adhered the long
Spill with blood, which is a method termed buy him "entitled healing by blood tissue."
I watched this case with the
greater interest as it upon my
experimentation from an examination of the clot. After a time the
upper portion of the clot became
separated from the surrounding tissue, so as to seem a pulsating
envelope completely surrounding it being nearly one quarter of an inch in depth. While
yet it had not exsanguinated,
the upper portion armed bleed
if touched with an instrument, 4 mm. running the indicated
blood. I found many large
numbers of clotted platelets which
phaged formation 5
that if red blood corpuscles. Still later slight purpurism being act in limited as far as unformed judge of the upper free surface of the clot itself. Therefore asked Prof. Chree to remove the small free papilliform portion of clot which he did. On recrining it, I at once fixed it in Flemming's Acet-Formic + Chromic mixture. Subsequently hardened it in a peroxide alcoholic as follows: 1. Water 2. 96% Alcohol 3. 35% 4. 50% 5. 65% 6. 75% 7. Methylated Spirit 9. Absolute alcohol, after which it was embedded in paraffin & serial sections made. A photograph of one of these is seen in Plate XV X68. Here it will be seen that scattered throughout the clot matrix are white corpuscles, but that in the free apex there are innumerable numbers. Of these were not
formed here it is difficult to see from whence they came. If
preliminariy examined and put
find them as numerous
throughout. If certainly could
not lie from the side as we see
that here they are least of all
numerous. Now as these are
as yet unbleed results in it, the probable explanation is
that they were formed here
by perforation, where the
exciting ferment (a large diplocecum)
cross situated
hammed by help force, we find
that in some situations a definite
formation of young connective
tissue is progressing. The cells
present all grades of transition
from white corpuscles to that
of connective tissue cells.
This observation indicates the
possibility of the original cells in a blood
clot taking part in subsequent
tissue formation provided there is entire absence of organised ferments. They made a very large series of observations upon me I have appended a few photographs of some of them. With regard to Dactylosporangium jessoform it is easy to see that it is directly analogous to bacterial leucocytes. Thus from in the first instance a few leucocytes in the healthy pore the presence of a pyogenic ferment there ensues a rapid putrefaction. But after a time as these accumulate there is insufficient material for their nourishment hence death takes place of those farther removed from the nutritional supply. This death is in almost all instances followed by fatty degeneration, which attacks first the protoplasmic reticulum later the nucleus.

The examination of pus from
Epithelial tumors as, for instance, the skin, cutaneous, nose, or has for me great interest as there been able to detect distinct involutionary processes taking place in the epithelium. Resulting in purus cells of a type known considerably modified from those we have just been considering. In such cases one frequently meets with peculiar cellular bodies which contain does not contain a nucleus or nuclei of which representatives are seen in Plato. 36 + 40 of the nature of these bodies there no definite knowledge whatever. With regard to such pus Bright relate a somewhat interesting clinical case. A lady had been employed in bed for several weeks, when one day she was slightly pricked with a needle this hormone was a slight an injury that she had no


...two days later, having the foot injured, the palmar portion of the terminal phalanx of the thumb began to swell but was not attended with much pain whatever. Three days later I was called to see it. I found what looked like a large whiteness, but which was peculiar in being unattended with any pain.

I opened it, and found it to contain about a teaspoonful of purulent material, purulent like pond, but underneath, the skin was quite white, so that I had merely to cut away the remains of the skin which had encased the cavity there, it without any dressing being required. On microscopic examination there were found large numbers of cells present which differed alike from pus cells as also from epithelium. A large number of an exceedingly small streptococci.
Many of the cells were quite disintegrated and appeared as reticular structures, possibly the remains of the interstitial network. In the stroma present, fatty degeneration, in the form of fine filaments not larger than microvilli, were found, but seldom affecting the nucleus, which in most cases was surrounded by a Ruher's in process of formation. In many the nucleus had 'fallen out' of the nucleus. Free nuclei of various sizes were also seen. Suggesting a probable condition of proliferation in all epithelial connections there are present peculiar irregularly formed, branched, budding, which are possibly derived from Atkin's irregular nuclei. They observed many times clear inclusions that were or crystals.
from epithelium, but note that
keratinocytes cannot be transformed
into epithelium, nor is that
at all possible considered
clinically as we often
merely have connective tissue
on a plane surface.
Thus these results implicate a process
occurring in epithelium may
result in a formation similar to white epidermis, but
ascending the scale phagocytosis
proved that the process stops
at connective tissue formation.
In the healing of an open wound
all are familiar with the
"slurp" of the purpose which
occurs by the so-called
"euphonic lymph" of Dr.
Hunter. But it is interesting
not how this is formed. If
when it is cleaned by a stream
of water left for a time it
will be seen that white cells
soon appear on its surface.
Some hours after appearance, as may be seen by making even finer impressions, a blurring of their outline takes place. They are seen surrounded by an aureole of a delicate fibrous structure.  

When this has occurred, there is present a fascial compartment film, which has been formed by them. Which is a fascial film nature to protect the underlying forming tissue. In this way it is not at all unlike the primary callus of bone. Wherever septic myositis enters here, the compartment film is penned in and prevents escape from a new film but meeting here the sepsis myositis, the battle ensues, resulting in suppuration. From what has been said is the formation of a pus pocket in an entrapment manner.
by the lymphocytes, it is evident
that their occurrence in a
trium which they have just
constructed, some of their
membrane many begin to take
upon themselves the role of
blood cells to form red
blood corpuscles, as here we
must have exactly the same
conditions that obtain in the
tissue. In this way may
the formations be accounted
for. If any confirmation of this
hypothesis he wanted, it is
found in the excellent research
of Stoffgan's with the formation
derformation of blood vessels'".
(Journal of the Royal Microsc. Soc., Apr. 14, 1880)
They show that capillaries are formed
from capillarized, long before they
become connected with the general
circulation, by white blood corpuscles
which arrange themselves in the
position of the afterwards occupied
by the capillary vessels. They shew
then that young blood corpuscles become formed within their cell by an endoembryonic process. 
Thus then it may be learned by the preceding statement that the condition of blood formation which obtains in the embryo is in fact continued throughout life.

It is thus possible to impose the white blood corpuscles to a colony of ants, among which we have some set apart for purposes of reproduction, others as workers and others for purposes of defence. In this way wherever there happens to be a breach of continuity of a tissue effected, a migration of workers takes place whose duty it will be to repair as best they may the defect if it happen that irritants be present we have them told off as to speak, if dealing them we may thus assume that
Pus formation with their accompanying microorganisms represents the white of two opposing forces of which one, the defending, is reinforced by auxiliary derived from the cells of the connective tissue in which the disturbance is located.

Relation of contents to pus formation
1) Red and non-accumulative foreign bodies
2) Accumulative foreign materials
of microorganisms

Clausenmanni, (Andis f. path. act. xxi)
later Matern Cheyni, by introducing under the skin of animals flow tubes containing irritant substances (cream oil) which were later purified when the healing process was completed produced a fluctuating prevalent like material, but which Matern Cheyni holds not where there is true pus, while in the contrary, the foreign observer, Bittmann, after according to only Kleinperer's statements are similar to Cheyni, he holds that the
exhibition in this way of pronun-
ciably constant does not cause suppuration
of previously sterilized, but only
a fibrinos effusion.
Directly comparable to this is a
couple of clinical cases which
came under my observation.
The first was that of a lad aged
fourteen, who was anemic and
manifestly below par. He came
to the Royal Infirmary, suffering
from a fluctuating swelling in the incision of the left deltoid
muscle, which was diagnosed as peritonitis, an abscess, or
manifestly peculiarly here.
however lay in his suffering
little of it, no pain. It seemed
there existed for 10 days or a little
longer. I drew off the pus with
an aspirator. In the naked
eye it had all the appearance
of glandular pus, but both
microscopic examination and
attempted cultivation in media
Pyogenic after they wrote fluid failed to show that any mast-
ary would had been present. It did not seem the pus at
all lent an hemorrhaged cellular
character, among which there were
she found a considerable number
of white blood corpuscles which
did not show fatty degeneration
which was present present in
all the rest. The cells, consisting
of red and white blood corpuscles.
Profusely discharged after
expectoration, so that the possibility
of its being tubercular was
emitted indicated. Probably although
a distinct history could not be obtained, it had
been caused by an extirpation
of an anterior produced by
a slight fever in a weakly
subject.

The second case was somewhat
similar but occurred in a
young woman, Mrs. Smith.
In a predominantly tuberculous region, over the hip joint. Like results in microscopic examination, culture, and obtained, but here in addition I injected a hypodermic syringe or into a rabbit which had not in six months shown any signs whatever of tubercle formation. These probably may be looked upon as the result of clipped injury.

During the past three years, the fallen Army left to San me all the tuberculous abscesses or wounds in the hands of Professor Cleanser. These during all this period have been few in which microorganisms were not detected either microscopically or in cultivation, with the exception of tuberculin specific material.

In some cases, which had home occurred during the past three months, one a carbuncle
The other a cutaneous abrasion, no microorganisms were detected. Microorganisms, especially, although carefully searched for, cultivation in tomato jelly did not succeed in showing any cocci whatever after the lapse of fourteen days, but when these tubes were then placed in the incubator for one night a pure cultivation in both cases of the staphylococcus. Pyrogenic Aureus presented the latter fact. This indicates most distinctly that such micrococci probably form resting cells, although we have not as yet been able to detect them. There frequently occurred in cultivation of certain micrococci, that with methylene blue staining some do not stain at all. There have been inclined to consider such as Anthranococcus, the more especially that such coccal forms remain on agar or for
Long periods during which they may be successfully incubated on fresh nutrient media. A similar belief is expressed by Paul Recht (Archief Grrc 1912-1930) and Observations of Path. VII. 1-234 (with regard to the appearance of Streptococcus Aureus.)

I have never observed microorganisms in pus taken from newly opened tuberculous abscesses, but such pus is always markedly different from healthy pus as much as to this, the case that in most instances, all in my experience, an immediate diagnosis may be made on microscopic examination. The pus is filled with debris in which only the fatty remains of pus cells are visible, a food for microorganisms (e.g., organisms that occur.
the pus may change assume
the microscopic characters
which are common in lundable
pus. In such abscesses have
found that if micrococci
are added access, even if not belonging
to a distinctly pyogenic group,
there ensues a copious yield
of pus, lundable in character
and it united with seen that
in such cases, the tubercle
formation just brooders in
the perinatal of the accessims
of a mild constituent merely
deeds the equilibrium.
In ordinary tuberculous foci
no cultivation planned he
obtained in incubated tis's
felatiner.
In specific tubo, these are
usually a large yield of
pus. Nothing of the nature
of mucic mycinum may
be detected, least of incubated
with Koch's felatine incubated
There has thrice appeared in my experience a bacillus, which
entrances from dust apparently
in two pieces in 10 min. Other
(Utyamile wind - Aparagi Post)
see photo.
These frequently found in healing
wounds, large number of mening...
present heightened absorption. Shall present henceforward this case immediately as one clinically simulating an anthrax pusule. Of the nature of absorption we learn very little indeed, and so that it is suggested that the process is carried out in the way indicated by Metchnikoff, who holds that the natural microbial off is invaded simultaneously by the white corpuscles. Having considered as for the process of multiplication in non fixed cells, a fact normally seen in abnormal conditions, it will be of interest to see whether we can trace directly analogous processes obtaining in certain fixed tissue cells as epitheliun. In order to illustrate this I shall bring forward three cases which have been investigated by myself: 1. An undescribed form of skidmore; 2. Tissue changes in a "etium" cicatrix;
A peculiar species of new growth
1st. A new skin disease, which may be
generally termed \textit{Puncta Transversa}.

I had 17 years old came into the
father of the Royal Infirmary this
year. The father had noticed a peculiar
condition on the left arm for the
which had existed from childhood.
On examination there was seen
on the anterior external aspect of the
upper arm a collection of small
dried-blood-like points, each of
which was like the remains of a
flexible, the area of disease and
measured three inches in length
and one inch in breadth.

Indentation within an oral space.
It was found to be impossible
to identify this condition with any
described disease. Hence I cut
out a small portion of skin
for investigation. It was hardened
first in paraffin so as to allow
of serial sections being made
on microscopic examination.
the first thing the student was to
terribly irregular arrangement of
the striated muscle
as may be understood by
the accompanying
chirographmatic sketch.
Long beams of epithelium were
projected deeply into the
column, looking at first flat
like autonomic ducts. These beams
are in many cases not clearly marked
off from the column and frequently
surrounded by proliferating connective
tissue capsules. In the columns marked
by many large numbers of such
capsules are the seen. Close up under
the papilla (see 8) there are blue found
occupying the summit of nearly
every third papilla of the column.
a collection of extravasated blood
being evidently derived by rupture of
one of the vasa efferentia of supply
to the papilla. Caution observation
shows that after death extravasation
has occurred, the epithelium
Dips down on either side of it subsequently encloses it, after which it is gradually raised up & cast off on the surface of the semi. After once being in the way encircled by the epidermis it is noticed that the stratum layer above it desquamates at a more rapid rate than normal and that when nearing in its upward journey, the free skin surface, the altered collection of blood emerges at the bottom of somewhat funnel-shaped depressions, as shown in accompanying diagrams. A very good illustration is seen in Photograph 42.

This case is of pecurier interest, as it happens that some pathologists hold that the first indication of the formation of epithelial cancer consists in the formation of a nodu


the corium. It may such
beami-like projections epidermis.
removed. It suggests that
attenua we may not always
have vascular demonstration of the
feet, yet foreign material occurred
in the blood such as leukocytes
may lie in great part eliminated
from the system in this way.

The next case is one of a tumour
forming on the external surface
of the femur, but not adherent to
or affecting the abscess.

The patient a woman aged 40
had had this tumour forming for
some considerable time, (definite
period uncertain) when she began
the tumbled with shooting pains
affecting it. He removed it by
denuding its attachment in all
depths. The mucinous membrane,
taking care to preserve the
actual tumour itself of foreign
close to the abscess beneath it.
On removal it was seen to be somewhat hemispherical in form, while measuring nearly 3/4 inch in its largest diameter. It was fixed hardened in acetic acid.

Microscopeal preparations made of a transverse section, the mesial plane, present a most peculiar appearance. The epithelial layer is tremendously hypertrophied. The accompanying sketch represents the epithelial layer magnified 20 diameters and gives some idea of the peculiarities. The spaces seen to be occupied by fine fibrous connective tissue of a delicate kind and blood vessels, but in some, more especially those near the surface there are blood vessels but no discernible connective tissue, the walls being evidently formed by
Modifications of the epithelium in which they aresituated. But when this epithelial layer is followed backward to the surface which had been connected with the
from the peculiar fact is seen that it turns inward, thumps the base of the tumor meets the epithelium at the round side. This band of epithelium at the base is most peculiarly formed in that there is a central core formed of flattened epithelium while papillary processes blend from it, on the one side outward toward the surface of the tumor on the other toward the firm. Among the superficial vessels, may be seen some in which thymus has taken place and the cancer may have been in the epithelium of the base. There is also the noticed a peculiar form of degeneration which begins in the canaliculus
formed by adjacent fusible cells in which there is first seen a
sclerotic acanthus, so that the
canals are more evident, but
following upon this, the cells
atrophy, evidently lay the inter-
cellular acanthus, so that round
nest-like structures are formed
which at the first glance
resemble "cell nests."
The difficulty here is to be certain
whether it is the epitelium which
to invade the corium or the
corium the epitelium. The corium
is in many parts occupied by
a very dense small cellled
infiltration Chromo 43, 44, 45

The next case is one of eburnous
occurring in a young man, as
the result of a cut on the palm
of the hand. The cicatrix which
had formed was removed in
Professor Allmand's words two
years ago. By the kindness of
Mr. Otterbe, the deer came out
my hands. It seems was well
marked before the operation
but ceased soon after.
On making sections in the same
plane of the oratrix, cataract
angle of the skin, my skin expose a
peculiar condition of the
epithelium was noticeable
somewhat comparable to that
in the last two cases, but
here the umbilicus of the papilla
of the cornua were occupied
by large bore-bearing bone
but no spores were observed
in the loose in the tissue which
seem to possibly been been
recognized if present as I
had prepared the specimen
in such a way as to show
them. The presence of the bone
in the post-scapal area here
is somewhat noteworthy and
almo to impose that the
post-scapal was the direct
effect of the presence of the microorganisms here present the cessation of the disease after removal of the exciting agent would indicate, taken in the light of microscopical examination that we have in leishmanias two conditions to deal with, one of which is the result of the action of the microorganisms on the peripheral nerve terminals; the other produced either directly by the microorganisms on the nerve endings, or by setting up this peculiar hypertrophying of the epithelium which proceeds might exert such effect as to set up a peripheral neuritis. There had been opportunity of examining the blood in two cases of leishmanias in man with microfilaria especially to try artificial cultivation for both cases I entirely
failed to observe anything.

The nature of microorganisms present, although in some cases the blood was taken within twelve hours of death, in the case of a horse whose blood I examined, while it was suffering from the same disease, I found at least three kinds of microorganisms present, but with inoculation experiments I failed to produce any abnormal condition. The material used herein was derived from cultures made from the blood. Plate 49.

**Septicemia.**

I have already stated that in the blood of a patient suffering from acute septicemia, there was to be noticed a very definite increase in the amount of white blood corpuscles, so much so that in certain fields of the
microbes, they were found as numerous as the red cells themselves. I propose to detail certain experiments which I made, with the object of seeing whether or not, in the first place, leucocytes were present in the blood at least 24 hours before death. If not, secondly, whether any peculiarity might be found to pertain to such leucocytes.

Of all microorganisms, conditions probably the destructive processes most of any have excited the interest of microscopists. Lepra is usually held to pertain to a condition, where the products of leprous organisms, confined to some definite area, are absorbed. Hence it has happened that lepromin is understood by many people, to denote a condition where leprous products are present in the circulation for my own part I question
very much, whether this condition has anything to do with truly septic processes at all.

Among the earliest records of bacteria being found in the bodies of those affected with traumatic infectious diseases is that of Biedleworth in 1866. Closer following this, we have Klebs, Recklinhausen, Waldvogel, Neeser, Berkhoff, Bischoff, the latter of whom concluded, that the unhealthiness of a wound stood in direct relation to the number of spherical bacteria present in the pus. Klebs was the first to indicate the manner in which wound bacteria penetrated the tissues of the cellular tissue and the eroded walls of vessels. Coze, Felt

V. V. Finkel attributed the corrugated form of the red blood corpuscles frequently seen in Septicemia to the
disease. And the adherent penetration of the bacteria. It is stated further in the case of the hydranemia found in hemorrhagic septicaemia diseases took the name of Cheyne. That the only other statement that had been able to find, as to the presence of bacteria in the blood in septicaemia, is made by Collman von Schaffenburg. He says in one case, nodules in the blood of the body formed from the vascular loops of the splanchnic. Rosenbach in these cases of septicaemia, which he subjected to bacteriological examination, found the Staphylococcus pyogenes aureus present in the pus. In two of the cases he isolated a bacillus of the kind denominated lejhim as Bacillus Periderm, Cultivation was made from the blood of the in two cases, in the first case nothing resulted from blood taken before death, in the second from blood
If the cardia taken ten minutes after death he obtained cultures of the saphrophytic pyogenes among the case with which I am about to deal, was that of true septicaemia occurred in a woman (C. G.) in the wards of Prof Chiene in November 1888. An operation had been performed of securing the mamma for carcinomatous disease & the patient died on the third day of septicaemia. Ecchymoses began 5 days later, a few days after a small quantity of blood from the peritoneal cavity was drained from the patient by the method which I have already described (B. M. J. 1887). The peritoneal cavity was efficiently sterilized, by first cleansing with soap water, then water, after which common salt solution was applied for 15 minutes & then drained off with eau-de-limon (1:20). The blood was inoculated into
Roche fecundate, often incubated
for 24 hours at 31° Centigrade.
On examining the discharge
from the wound, it was noted
that there was little or no
pus, certainly if the naked
eye there was none. In the
discharge, which was semi-
translucent in quantity, a few
eucaryotes were seen
but all altered in characteristics,
hosting their outlines destroyed
by blurring & among these
and the semi-sparse number
of a peculiar bacillus & a
microorganism, strongly confirm this
discharge was also cultured.
By examining corresponded which
had been prepared with the
blood taken at the bedside
of the patient, there was to
be noticed as I have said
a definite eucaryote core, but
only one of two bodies colored
he seen which looked like
measurc.
Day looked like microcini because no one conversant with such methods knew it is necessarily difficult in such cases to be absolutely certain of the presence in such materials of related spherical bacteria. Cultivation of the blood showed the presence of microcini. In a few hours, after incubating for 48 hours, if the microcine present it was seen that they tended strongly to settle in the gelatine while the few bacilli present were found hanging in slightly cloudy cloud-like masses in the upper parts of the tube. They continued transplantation but last attained pure cultures. It was proved by making incubations not after after when nothing grew at all. This bacillus usually not
four in 4% while the 

frec them consequently.

The leucine in furedine, measure

ed in 4% 2y in length by 1y breadth.

it was comparatively thick, more

stained very deeply with

fuchsin & almost in every

case showed an appearance

like foam formation. Further

by a form of degeneration of

fusii pride & thin as bodies

which preserved a bactelform

thread-like shape. At its best

it joins many bundles not at

all in neutral or faintly

acid solutio of boullem &

not at all on 4% 4% or

hydroxide fluid or potase.

Mended rapidly & die even

when transplanted, this

degeneration already noted

becoming day by day a

more evident feature, until

attack failed altogether

to keep it from us. Photo 211V
While yet forming fairly well, I inoculated this former fetus & a rabbit with it by subcutaneous injection into the subcutaneous cellular tissue at the root of the ear, but this only was attended with negative results. The blood however showed a definite temporary increase of white corpuscles. The microorganisms do not form in saline unless incubated but fairly well on incubated agar agar forming here a greyish white film which tends to form colonies. In one the individual cocci measure from .5 to .14, .75 being the average. It is unmistakably a Bacillus of this type. The microorganisms found in the four agreed in all particulars with those derived from the blood. P.h. 5.6.
The chief point of interest connected with these micro-organisms is their difficulty of forming on artificial media, more especially the bacteria. In fact, a photograph is seen in print generally speaking, the true pathogenic bacteria form only too easily in cultivation media, whereas with the exception of anthrax, nearly all the pathogenic micro-organisms known from with difficulty for many cases only in special media. This case illustrates in a most marked way, that for the production of septicemia in certain cases at least, carrier reflexive micro-organisms are necessary.

The next case which has fallen to my lot to investigate is that of a man who was admitted into
Professor Annandale wrote, suffering from a sore on the arm which in certain respects resembled an aneurysm of the aorta. He stated that he had seen a disease in dressed wounds, lesser in form, but much more severe. I did not see the condition described. The species of the case which was done by Professor Annandale was the Poluli. He said that the presence of a black spot was much depressed, as if active ulceration had been going on. Named a case that presented ulceration, a vascular condition had obtained. Even after a crop of ulcers formed at some distance from the wound, the lymph from them did not produce any effect when inoculated by Professor Greaves into mice. With the normal Pasteur's usual precautions.
removed several small portions
of tissue from the centre of
the lacerated pore & also from
parts near the sound tissue
incubated them in Rochat
jelly. Jellies made in medium
in Rochat jelly of the blood
from the immediately surrounding
tissue. From the blood I have
isolated & cultivated a microcosmic
bacillus & one pneumonia bacillus, while
from the tissue these in the
same way isolated & cultivated
two forms of bacilli & three of
micrococci. The separation of
the tissue microorganisms has
been attended with considerable
difficulty. By separation on gelatin
plates I was enabled to isolate
two of the micrococci, one of
which turns out to be a disease
previously described by myself
as the M. Caprafermanni, W.M.G.
June 11, 1887. The other I do not
know. It seems less recently m.
After agar forming has a greasy film limited for the most part to the needle strike, but turning not in each side after 7 days leaf-like expansions. On gelatin plates it forms somewhat hemispherical greyish white points 2-3 mm in diameter, which don't liquefy the gelatin. In lactate NaOAc 2% medium it forms fairly rapidly. The surface forms to nail-like in form, somewhat hemispherical, not unlike the Bacillus Breenii of Lordladee, but having a rather more flattened head. The needle track is made up of a minute eccentric부터 tapering to a fine extremity.

The individual cocci measure 0.75 - 1.2 μ in dia., 1.5 μ man.
Fattigerei 5 dozen yeast & rabbits.

The New micrococci separated in this way, from in a creng
in a similar way, only that the
colour is rather of a yellowish
white, the nail-head is much
fatter marked & the fourth m.
agar always shows always a definite
tendency to form discrete
hemispherical pomis.
The intestinal cocci measure
0.3 - 0.5 μ in dia. many possess a wall.
It is not fastidious to
Guanepys or rabbits.
Of the two bacilli-
the kind forms with great
difficulty in Stoks gelatin
remains entirely limited to
the needle-track forming there
a line hardly differentiated
into areas, or rather in which
they are as closely appressed
as the individually distinct
un Fusiform. On agar agar it
forms when incubated a quickly
spreading translucent
lacy & forms spores after 4 days.
Incubated in sulfitone it forms
a peculiar crumpled pellucida thread the jelly-like after a week entirely liquefied. About 50
the lesion measured 7.5 cm dia.
& 2.5 cm depth.
I inoculated two rabbits one
surviving with fluid of a
cultivation by contusion
injection. Only in one case
(a rabbit) did any result
hence & in it there formed
not in the site of inoculation
(the back of the neck) but
on the left side a large abscess
after the lapse of 26 days
following the inoculation &
during which time the animal
had shown signs of illness
refusing food, lying listless
even when touched through
a shiny fur. On opening
the abscess no mixed organs
were to be seen. The pus was
very handable for rabbit pus
& flowed easily when opened.
Cultivation of the virus in tissue culture was not successful; no culture of the virus organism, but nothing was obtained from the blood. The animal was then killed and a post-mortem examination carefully made when no disease was found in any organ, tissues, or special organ looked for.

The remaining lesion was isolated with the greatest difficulty. It formed a globule even in Torsella's saline solution. When incubated at all in the cold, it formed a dense mass. Agar agar showed an emulsion not easily separated in the form of the primary form's organism. Therefore had recourse to a different method of procedure. Found by much experimentation that it formed astonishingly well in acid borax, and the others in this medium seemed hardly form.
at all, hence byj gradually
increasing the acidity of a
series of floccs of blood in a
lactic acid vat last for it
reconstituted as a pure culture.
Incubated in agar agar and
incubated it formed a whole
moss which clumps mostly
the liquid area which is
commonly present at the
lowest part of an agar tube.
Incubated with blood globules
incubated, it does not cause
any opalescence in the
jelly merely for an indication
its presence therein when
the jelly is disturbed by gentle
shaking when a thrommer is
seen as if minute chlotom in
ecutals were distributed
throughout its contents. Photo 55-57
the bacilli measured 0.75 µm dea
or 27-47 in length.
They have a similar form of
degeneration is what obtained
in the pepticonic bacillus.

But differing from it in
fermenting fairly well in acid
media.

Inoculated with two rabbits,
there has only been obtained
results in one case. In this
one after the lapse of 14 days
a swelling appeared behind
the neck (instance on Saturday)
and on the following
the animal was found dead
the swelling had burst and
charging bloody serum.

It was seen that the skin was
excised from off the occiput
while well marked of ranula
Changi had occurred, so that
the cartilage of the ear was
separated from its attachment.

No trouble of mucosac was
seen in this tissue or the
other portions of the body were
(allowing for a change) fairly
normal.
The mucoid eumus separated from the blood, forms slowly a Kossa-like golden eumus, which is liquefied by it. At first a central thread is formed which, after 14 days, falls down, assuming a spiral form in its descent, after which a funnel-like area of liquefied golden eumus forms. Liquefied golden eumus then joins on fairly rapidly, until in each of the tube is liquefied, after which the rate of liquefaction is very slow indeed.

In gelatin plates it forms minute points which soon harden to form at all or its not cause liquefaction in 21 days.

On agar-agar it forms when incubated a yellowish white ribbon, somewhat like Staphylococci Oxyces. Aureus, but much paler in colour. Photo 58.

The cocci measure 0.5-1.0 μ in dia.
Infected in rabbits A. suis, by making a slight section of the skin, it always causes a very decided inflammation with formation of a papule in 26 hours and a secondary nip of second papules in 72 hours after which the fever declines. There is neither residue nor pus visible formation. Subsequent to this I injected a large portion of the original toxin under the skin of a rabbit, one of those in which no reaction had been obtained by inoculation with the bacillus, and in 72 hours the whole mass was absorbed. Following this the animal was inoculated with an incredible amount of an authentic culture in order to make absolutely certain that it had not been anthrax material with which I had been working. The animal died in 48 hours, of anthrax.
A photograph of the spleen pulp is seen in photo.

Certainly enough this animal was a female that had an opportunity only three days before of becoming pregnant. At the necropsy, it was found that the mammary glands were full of milk in which I found bacilli. Examination of the uteri showed that it was not more than three days pregnant if at all, as the pyramids were almost nil.

Examination of the scrotal tissue.

On making a median section in the mesial plane of the scrotal tissue, it is observed that the section presents numerous points, which vary much in size and are occupied by stratified bloud. The interstitial tissue after hardening is somewhat paler than normal. Sections stained with a lactic acid show the condition of 8 transverse men
see photos 46 47 48

In scanning with a high power (x 100), we notice that in addition to the ovoid collections of blood which are in some cases getting large see photo - there are quantities diffused through the tissue. Under a power of 400 diameters, it is seen that the tissue is closely packed in various directions and became nucleated in all stages of division. The inflammatory changes seen most marked in the deeper tissue. The vessels are much engorged in some cases packed with leucocytes, so that it is safe to infer that a condition of thrombosis has been established in certain cases such vessels there are. The red corpuscles occur among the cells within it in many cases included within the peripheral leucocytes.
A plan of the condition which may be verified by the usual slide to 5 cm. It is, in this case, the most careful histological examination, with the help of the microscope, failed to detect any bacilli. It is therefore the looked upon as a curative case. In certain respects it is somewhat similar to malignant edema (Koch) [Koch] vibriomic septique [Protein] but the difficulty of detecting in the tissues, bacilli, is somewhat against such a theory.

The few preceding cases, represent some of the more interesting conditions which have occupied my leisure time during the past year. Reece it shows the difficulty of winning uninvolved in some of the few facts, which are unfortunately often of a negative character, in the domain of human infectious diseases.
The determination of the value of some antiseptic agents

Dr. Koch five years ago stated, in his preliminary remarks upon
the subject of disinfection, which was at that time little under-
stood, that the method of action of antiseptics had not been
accurately known. He considered that one great reason for our
ignorance lay in the fact that we knew very little indeed
of the precise nature of infection. That was then said and has
already almost equally at the present time, although by
his labours those of his colleagues we have since made considerable
advance in knowledge.

Of the firm theory of infection. Infective agents, he correct;
it necessarily follows in the light of these researches that
our old-fashioned ideas of disinfection are useless in
practice, for instance, acetic acid placed in a vane or thus allowed to settle into a room is absolutely useless, as is also the method of heating apartments by means of pieces of burning sulphur. But knowledge of the action of antiseptics is based upon results obtained, but the action of certain antiseptic agents upon particular organisms, that is, upon bacteria, cannot be obtained by this means. The knowledge gained cannot with absolute certainty be applied to any particular organism unless the special ferment inducing the particular disease is already known. From the knowledge obtained, we can easily estimate the strength of an antiseptic.
likely to cause destruction of the
tubercle bacilli. Because we can
easily obtain pure cultures
without the taint of tubercular
bacilli is experiment with, or
in order to stimulate the necessary
antiseptic powers for the destruction
of the tuberculous amphi(the
Lymphatic experiment with lymph
taken at a suitable time;
hurt in this case, order to
possible failures, the number
of experiments made appear
likely to exceedingly numerous
in order to exclude the
possibility of all cases. As
for our knowledge, it
is a clearly evident fact
that microorganisms are
not all equally acted upon
by antiseptics, that many
of the more common non-
pathogenic bacteria are much
less easily destroyed than
Certain pathogenic species of which Anthrax furnishes an example. Of all microorganisms the spores of those bearing bacteria are by far the most difficult to destroy; but the same statement cannot be applied to the fungi developed actually forming organisms of the same species. According to Koch, a solution of carbolic acid, of the strength of 1 in 1,500 or 1 in 833 presents the former of Anthrax bacilli, while for certain others 1 in 500 is necessary. Exposure of the spores of Anthrax bacilli to a solution of carbolic acid of the strength of 1 in 33⅓, for a week did not affect them; a 1 in 33⅓ solution only succeeded in destroying them in 7 days. So that we may infer that in any agent capable of destroying the spores...
Of antiseptic value quickly, we have a trustworthy efficient antiseptic. Tested in this way it has been found that carbolic oil (8%) did not affect antiseptic ability after exposure to it for 110 days, only killed the former bacillus in 24 days (Proc. 1886). Compounds of carbolic acid seem to be much less efficient than the acid itself. Chloride of zine in a 5% solution and well antiseptic 9 times in one month. Such compounds conclude that such antiseptics are for practical purposes useless.

Dr. Ahmed discreetly like to accept these statements as applying absolutely in the practice of antiseptic surgeons, I think that probably that many others will agree with me in these.
there therefore rises the question, how is it that carbolic acid is successfully made use of as an antiseptic? — and I think that no one will deny that it is so. Nor are we anything to wonder at in the part of the tissues themselves. Do they not exercise an antiseptic action, though perhaps slight in agree a varying with the constitution, general health of the patient. Would any one find as formidable a prospect for an operation upon a diabetic patient, or one suffering from chronic atheroma as on a healthy patient? Koch himself has shown that if anthrax material be injected, the bacilli are destroyed by the sooty juice of the pox-scab. This intestinal anthrax
always arises from sore injection - a fact by the way which tells strongly against the coelac theory of such diseases as are disseminated by milk. Other articles of diet turned suggest to us that meat or dessert should be taken when a plentiful supply of pectoral juice is still available, to see to get the benefit of the antiseptic action thus afforded. Further, one  stimulate an animal by hypodermic injection with a non-pathogenic micro-organism, how is it that the bacteria become so quickly destroyed? Metchnikoff, has shown that in the case of non-virulent anthrax bacilli the rods are taken up by the white corpuscles. Thus destroyed, these in such observations.
a theory that protective inoculation
proves the white exudate to be
the poison which they did
not previously possess of
absorbing their destructuous
irritant bacilli.
We know that the presence
of an irritant in the tissue
is always followed by inflammation,
or we can then presume
that pus exudes, evincing
as they do if white exudate
or their homologues, may of
themselves in the way destroy
any organic particle, while
may chance to come in
contact with them. Thus
as most of the antiseptics
in common use are undoubted
irritants, they, while serving
in virtue of their antiseptic
powers an inhibitory action
on the microorganisms entering
a wound, at the same time
call forth in virtue of their
brunt of action, an army to
repel their already disabled
invaders. Whether such a view
can be at all tenable or not,
we are forced to acknowledge
that the statements thus
permanently adduced with
reference to carabolic acid do
not entirely agree with the
results obtained in the
practice of antiseptic surgery
when using these identical
agents. On the publication of
Koch's results therefore Greeks
began to heed as to the
permeability of the firm dam
forbidding antiseptic carabolic
acid, following upon his
advice, the use of cocaine
sublimates began to be common
in surgical practice, which
use I believe still largely
obtains. But with what
results? I think that the
balance of experience at
Opium and tinctures chiefly that in treating of fever or other
inflammations, we have been learning upon a practical
reed. However, one must
it from another point of view, we deemed this aspect of
that with a gradual increase
in the use of corrosive subl.
etc., there should be a correspond-
Acalemnii in the use of carbolic
acid, but I learn differently.
The dispensers to the Board's
Royal Dispensary, Mr. Charles Arthur,
informs me authoritatively
that and in spite of the
increased use of corrosive
materials there is a greater
demand for carbolic acid
in the shape of aresenics and
lotions than before corrosive
balsamate was so much
used. In view, therefore, of the
somewhat conflicting statements
obtaining, I determined upon

a course of experiments with several antiseptics, in however a somewhat different line from that usually adopted, more nearly akin to the conditions one finds in surgical practice. Previously however to detailing these I must refer to a communication made to the Royal Society of Edinburgh (18xx) by Dr. R. Woodhead. It shows that if one add 5 cc. of blood to 50 cc. of a solution of common salt water (i.e., 10%) nearly every trace of the mercuric salt is precipitated as albuminate of mercury, the pertinently adds that, although the albuminate of mercury is soluble in excess of albumen, it does not necessarily follow that it appears there as perchloride and therefore may not thus possess any antiseptic
properly. After considerable experimentation with various mercury salts, he states that it may be concluded from the results of the experiments of numerous workers that all the mercury salts which can be kept stable in solution have powerful antiseptic and fungicidal properties, namely:
(a) according to the quantity of mercury they contain, and
(b) according to the acid with which they combine.

In surgical practice, two great principles have been kept in mind: first, antisepsis, which is the prevention of sepsis in our wounds; second, to remove sepsis if possible when it has occurred in a wound. In practice the first is usually, with proper precautions, fairly successfully managed, but in the case
Of the second, it is the Sceptum rather than the rule to find it accomplished. Of course I do not here refer to small wounds, which are much more easily managed, but large ones, the lessons of recent operations— as for instance, such a wound as is made in the region of the mamma, large deep contus, like those of poor accidents. There in my experiments endeavored to keep under the two conditions, I do arrange that they might be applicable to them. M. Nathan Chynne has stated that the results obtained after inoculating animals with certain bacteria went to show that, while large cles produced death, smaller ones only gave rise to certain local manifestations. The theory formulated is that laws
namely
1st. The pathogenic dose of a virus
varies inversely with the predisposition
of the animal to the disease in question.

2nd. An animal must remain susceptible
to a disease, the severity of the
infection varies directly, within
certain limits, with the amount
of virus introduced.

3rd. Up to a certain point the length
of the incubation period varies
inversely with the amount of
virus introduced.

In a somewhat curious manner
whether or not any analogy
could be drawn between such
animal experiments and those
which consisted in the inoculation
of antisepticised culture media.

It is a somewhat noteworthy
point that in all observations
made with regard to antiseptics,
absolute statements are usually
made with regard to the
antiseptic or fungicidal properties of certain agents, as, for instance, that a solution of carbolic acid in water (strength 1 in 500) will prevent the growth of certain bacilli. If one employs the statement of Koch & Fleim with reference to coccine cultures, they will find rather striking discrepancies, but which I think can be explained by the fact that in no case has any standard test been employed, or if it is, the fact that it is almost impossible to standardize any test which will persist. While workers have in each case stated exactly the strength of the antiseptic, they have not stated the amount of microorganisms present. Made use of for inoculating the culture media, or the actual work upon by the antiseptic, hence if the readiness of Standard solution become confused.

The
at all with the amount of bacteria introduced thereto, it is conceivable that there will be in all such statements a possibility of undue discrepancy.

To avoid mistakes, the only way is always to institute a series of comparative experiments, to thus, for an example, if two persons working on different lines with antiseptics of various kinds, happen each to the experiment with one in common, it is easy, by considering the results obtained by each with the special antiseptic, to apply comparison of the others.

Experiment. This consisted in placing in each of a large number of test tubes 10 cubic centimeters of a nutrient solution, made as follows: 10 parts fluid meat 90% Cane Sugar 1% Water 5100 parts. These were then plugged with cotton wool saturated
Subsequently they were divided into three series, namely, Neutral, acid, and alkaline, in the subsequent operations each inoculated with an equal amount of the same organismal material. The inoculating material consisted of a mixture of the following bacteria:

1st. Bacillus subtilis.
2nd. Bacillus licheniformis (Bac.プ).
3rd. Leptolyphlococcus Pyogenes Aureus.
4th. Red colored formula.
5th. Bac. lutea.

In these I had a number of morphologically, in some cases, ates, physically, distinct microorganisms. After having inoculated the test tubes containing the solution in this way, they were then plugged placed in the incubator and kept at a constant temperature at 32°C for 48 hours. At the end of this period observations were made, summarized as follows.
Note: In these experiments:

O signifies that the pancreatic fluid so far as could be judged by the eye,

that after being microscopically examined and inoculated into fresh gelatine, they were found sterile.

+ signifies that coagulation had developed.

+ signifies that they were perfect.

Note: Hydrochloric acid is only available at the start of 1:1000.

<table>
<thead>
<tr>
<th>Strength</th>
<th>Hydrochloric Acid</th>
<th>Carbonic Acid</th>
<th>Conaci chloride</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:10</td>
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<tr>
<td>1:20</td>
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<tr>
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</tbody>
</table>

Note: Hydrochloric acid is only available at the start of 1:1000.

in cold water. Rinsing all the tubes from 1:1-300 up to 1:1000 had a crystalline deposit of the same.
Experiment II - The tubes of series I were reopened and again incubated with an extra drop of culture material and again incubated, with the result that several tubes which had lost the addition of the first drop now became turbid.

Table II

<table>
<thead>
<tr>
<th>Series</th>
<th>Hydrochloric Acid</th>
<th>Carbonic Acid</th>
<th>Carboxylic Salts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 m 3000</td>
<td>O</td>
<td>+</td>
<td>O</td>
</tr>
<tr>
<td>1 m 3600</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>1 m 4800</td>
<td>O</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>1 m 6000</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>1 m 7200</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

Experiment III

To control the last experiment several tubes were prepared as before with nutrient liquid, then incubated each with 20 drops of a very 10 parts cent per cent samson fluid (the same fluid as before, but having added 5 m an equal volume of very 10 parts cent urine) and incubated for 48 hours.
Experiment IV. These tubes were then again opened & inoculated, with 3 drops of the same fluid as the last, added to the amount of one third its volume with sterile water & again incubated for 48 hours. As a result of this the tubes remained in static fins.

Experiment V. To Table II I took the tubes used in that experiment (Table II Exp. III) & inoculated them with 3 drops of a culture fluid & then placed them in the incubator for 3 days. As a result of this it was found that the controls & tubes remained unchanged while all the Hydromycetes tubes developed opalescence, except the 1 in 2500 which remained sterile.

Table III

<table>
<thead>
<tr>
<th>Strength</th>
<th>Hydromycetes</th>
<th>Corrosive Sulphate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 in 2500</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1 in 3000</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>1 in 3600</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>1 in 4800</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
So that, from a consideration of these experiments, we may conclude that, while the addition of organic material in a certain quantity to an antisepticised putrefactive fluid may not start septic fermentation, it yet in some way weakens the strength of the antiseptic present, so that if a subsequent addition of the same organic material is made, septic fermentation may be induced. I have further found that this is not altogether dependent on the addition of living organisms, as a like result is obtainable if one adds at first, instead of living organisms, a piece of pellicle from a cultivation of Bacillus subtilis which has been boiled. This, therefore, suggests that the antiseptic enters into direct combination with the mucous organisms. I may further mention that by experimenting on
On day 1, we succeeded in setting Bacillus cultures to form a colony in a 1 in 5000 solution of copper sulfate. To form a new colony, prepare thereupon.

**Experiment VI**

This has been prepared to obtain a better understanding of the experiments conducted in making an experiment more similar, but with this exception, that the nutrient liquid in which the antifreeze were contained had added to them in each case.

0.75% Hydrochloric Acid

| Height | 360 | 480 | 600 | 720 | 840 | 960 | 1080 | 1200 | 1320 | 1440 | 1560 | 1680 | 1800 | 1920 | 2040 | 2160 | 2280 | 2400 | 2520 | 2640 |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Hydrochloric Acid | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Carbon Acid | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Current  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
Experiment VII - To control the addition of HCl, 24 tubes were each prepared with nutrient fluid and had added to each 0.75 N HCl as the antiseptic, while 4 other tubes had 1.5 N HCl added. They were then inoculated with the organismal fluid used for incubation. As a result, it was found that all the tubes containing 0.75 N HCl became opaque in three days, while 1.5 N HCl acted powerfully as an antiseptic. The tubes containing the quantity remaining apparently sterile after the addition even if a second dose of the organismal fluid was incubated for two or three days, but began to fail on the third day, so that we have to conclude that the addition of this quantity of HCl (0.75) strengthens the antiseptic action of the agent used.

Experiment VIII - An experiment similar to that of above, but differing from the
last in boron 0.75% KCl added instead of WC
Table V

<table>
<thead>
<tr>
<th>Strength</th>
<th>Hydramaphite</th>
<th>Carbonic Acid</th>
<th>Collosaic</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>350</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>450</td>
<td>0</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>500</td>
<td>0</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>550</td>
<td>0</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>600</td>
<td>0</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>650</td>
<td>0</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>700</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>750</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>800</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>900</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>1000</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>1200</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>1500</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2000</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3000</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>4800</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>6000</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>7200</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
At this stage it was suggested to try a series which included Alphaphosphatase, Phos-
phatase, and Phosphatase. The action of
Alphaphosphatase, Hydrophosphatase, 
Carbonic Acid
1 in 4,000 1 in 5,000 1 in 10,000

in decoys from meat, more from
breast muscle, after incubation 
three days incubation at 36°.

In test tubes all went normal
developing well marked froth.

Experiment X
Four beakers had each added
50c.c. one ounce of freshly minced
beef. Then into one was placed
100 c.c. cubic centimetre of 1 in 20 Carbonate
into another 100 " 1 in 40 "
into another 100 " 1 in 1,000 Carbonic
into a fourth 100 " 1 in 1,100 Hydrophosphatase.

As a result it was found,
that in the case of the 1 in 20 Carbonate,
the meat on which it had
acted had become converted
into a mass of sarcocinic hydrolyte.
Normal, which owed hardly the for
off the drawing rod, while the supernatant fluid was quite clear, consisted only of water and a certainty proportion of caustic acid. The 1 in 40 caustic acid and 1 in the same result as regards the supernatant liquid, but the same condition of meat was not obtained. The particles in this case remained as distinct as they were when placed into the beakers. In the case of the corrosive no change was observed in the meat, but the fluid became of a dirty brown colour, those an addition of acid reaction. Silicic litmus paper. The 1 in 1100 hydrometatoh acted, as far as one could see, exactly as plain water does. The supernatant liquid being of a bright red colour, rising as sprind. The hemoglobin remaining unredced. There is note, however that the hydrometatoh
Also, for certain tents, combine with the albumen of the eggs, but the combination is effected somewhat poorly.

I determined to test the action relatively of convulsed paralysed by the action of bacillus anthracis Bacillus putridus. In order to do so I made use of a somewhat different method to that of Luck. I prepared a series of small pieces of brass tubing, each 5 centimeters long, having a bore of 7 mm. diameter. The one end was made slightly smaller than the rest, which had a small hole drilled through it for suspension by means of a thread. Into each was then placed a small loose plug of wool, which was pushed down to the small end. A thread having then been passed through the hole at the side of the mouth for
Suspensions, the whole was then included within a test tube, which was then sterilized in the last air chamber for an hour at 150°C. The tubes were ready were each prepared as follows: One tube was unplugged, and the piece of glass tubing drawn up to the mouth when a suitable piece of dense material, lifted by means of an oë, in the mercury of a glass from the surface of an agar cultivation of bacillus anthracis. One tube from an old cultivation of bacillus anthracis, was passed in hand upon the plug of glass wood. After this there was poured into the test tube 15 cc. of a culture solution of the anthrax bacillus. The tested there allowed to remain until the expiration of a certain period of time, when the tube was removed from the test tube.
Suspended in a litre flask filled with sterilized water, under which the spore material was removed, placed in a test tube of Rocha jelly and subsequently incubated.

Subsequent to this experiment a modification byashing the hydramaphthit treated spores first with 75% alcohol, in which it is then boiled 20 minutes.

Table VI. Bacillus Subtilis—spores.

<table>
<thead>
<tr>
<th>Antisepctic</th>
<th>10</th>
<th>12</th>
<th>15</th>
<th>20</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Concent 1 in 1000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Concent 1 in 1000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Control</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

○ = Spores unaffected, so that they germinated successfully on being inoculated with fresh saline inoculated.

□ = Spores slightly affected, so that slight growth resulted on inoculation inoculated.

● = Spores destroyed—no growth on inoculation.
Table VI  Bacillus Anthracis Anthracis Spores

<table>
<thead>
<tr>
<th>Number of minutes during which spores were exposed to the autolysate</th>
<th>10</th>
<th>12</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autolysate</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Convalve 1 in 1888</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Hydromedlined 1 in 1888</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

O = spores destroyed = no growth on incubation medium
O = slightly affected = slight growth

In these experiments it will be noticed that in the cases of the 10 and 12 minute exposures, apparently contradictory results have been obtained, but this is I think explained by the fact that the quantity of spore material varied as unspor the exposed in each case.

In the case of spores treated with hydromedlined & washed only in water, no growth resulted in the case where spores exposed to it for 10 minutes.
From a conception, therefore, of the preceding experiments, it is
believed that the two principles of prophylaxis and cure of disease are
each specifically distinct from the other. Furthermore, that certain agents capable
of being efficiently used as prophylactic agents are absolutely useless as
curative agents, if once it gets to a start in a wound.

In other words, germicide and antiseptic are two very different
terms. Further, between the minimum and maximum action
of any special antiseptic, we have carefully to differentiate,
as we see that the minimum is easily vanquished, and it is
upon the former that we have mostly to rely in practice.

We have thus seen that the maximum antiseptic action
of corrosive sublimate lies very nearly at 1 in 4,000 while
The minimum is 1 in 15,000. In the case of hydriphoniasis, the minimum lies somewhere about 1 in 7500, while the maximum lies between 1 in 7500 and 1 in 3000.

Carbolic acid used with the steam spray is undoubtedly an efficient agent. Proper care & assistance be attended, but in hospital practice, many circumstances, in some cases, combine renders futile all attempts at antiseptics in this way. As the result of careful observation, I deemed pay that the carbolic spray is most likely Render efficient service in private practice, when it in surroundings can be kept under the personal supervision of the surgeon himself, but should be dispensed with in hospital practice. If a more stable substitute can be readily obtained.
If carbolic acid is to be used as a disinfectant for instruments, jars, etc., it is evident from Koch's statements that they must be immersed in 1 in 20 dilution for at least 2 days. If this is impracticable, the other alternative is to boil them for an hour in water beforehand, then to immerse them in lotum. But we also have to note that the tray containing the instruments must itself be aseptic. This cannot well be if the lotum is simply put into it just before the instruments; I suggest the necessity of having the lotum in for a long period beforehand. This, of course, will appear to many as an excess of fastidiousness, but, if we are to follow the dictates of science, it is absolutely necessary; not only so,
but anything short of this is simply to court failure. The use of carbolic acid for washing out wounds is at least a dangerous method of procedure. They already show that, as the result of the action of 1 in 50 carbolic stim upon muscular tissue blood, there is formed a viscous or glue-like mass. If applied to a wound, there is formed on the surface of it a distinct layer of necrotic material. This like most dead tissues forms a suitable medium for the growth of bacteria. Supposing, then, that carbolic irrigation be efficient in destroying the microbes present in a wound, this necrotic area has still the coat off, contributes in this way a form of suppuration, during the progress of which
Accurate care will lose the taken in order to prevent the entrance of fresh bacteria. But as it happens, such a proceeding is hardly likely to be successful. The surfer using this method simply makes matters worse, in that, while he does not delay opera, he manifests directly to the injury the micro-organismos patulator in which he is. Thus we see that caustic irritation, instead of leading in the direction of the cure of sepsis, predisposes indirectly to pyemia or septicaemia. Coming to meets the need of corrosive putollate, we have to note that it also causes the formation of a necrotic area spread for irritation, but in a different way from caustic acid.
the fluid left is still caustic acid, although its strength
may be considerably reduced,
but in the case of corrosive
sublimate the mercury salt
is almost entirely decomposed,
so the tissues we have a
distinguishingly non-corrosive agent
left in the form of the albuminate
of mercury, which being
soluble in excess of albumen,
is thus liable little absorbed.
This, of course, inhibits the
free use of this agent in the
case of large wounds. Corrosive
sublimate is undoubtedly
useful as a preservative of
distilled water. Others prefer
to perform admirably when
used by bacteriologists for
moistening the filter paper
in plate culture apparatus,
but its use should be
restricted to such. These
purposes for even if ordinary
water be used, instead of distilled, the mercuro cautex is found reduced, as shown. We now come to consider the new antiseptic, hydroniophsimb, I shall explain immediately what it is. It has already been shown that for antiseptic purposes it is, when dissolved in ordinary water, not much more than half as powerful as corrosive sublimate. When dissolved in distilled water (1 in 1000), but under similar circumstances, as the person who reads with, it is much more powerful than corrosive (see table X). Further, as it is non-poisonous and, if properly prepared, a saturated watery solution of 1 in 100 may be freely made use of. Considered from the point of view as a farmicide, it is seen that it is at least as powerful as corrosive.
Rubellins for anthrax and more so for bacillus subtilis, when the latter can be grown under conditions most advantageous to it. Therefrom 3 forms in one day. I repeated it on three occasions successively to same effect without any effect. I have myself taken it without experiencing any result whatever. It is further reported that doses of 50 grains have been given without any untoward symptoms whatever. Taken in this way, the use of hydramaphthalate is suggested to me as an internal antiseptic. I have thus experimented with it on animals and gramineous plants are inoculated with anthrax bacilli. 5-7 hours later one had grown in it a form of hydramaphthalate ingested by mouth. Repeated on three occasions afterward with an
internal of three hours between each dose, but both the animal
the "control" or died of anthrax
death, however, in the hydramphenate
treated one being apparently
delayed for 24 hours. Hence
Vattali's importance. Thus
as I have found that hydramphenate
acid much diminishes its
antiseptic force. It causes it
much more quickly to enter
into combination with the
tissues. Hydramphenate was
also named by Dr. Justus V. J. of
New York only a few years
ago. It is a secondary compound
of naphthalene, differing from it
in having a molecule of hydroxy
instead of an equivalent of
hydroxide. Its formula is $C_8O_4H_2O_4$
If it is mixed to make use
of it for internal antiseptic, I need
suggest that a solution of it in
almost systemic be injected hypo-
-dermically. There made use of
the following solution:

Hydrenophtalate 1 part
Alcohol 3 parts
Elycamine 5 10 parts

with the best results, for injecting into the cavity of foul abscess or into tubercular processes. For the latter purpose I think it is predominantly fitted for superseding the use of codlinum eucalyptus oil.

In a case of submental abscess where one appeared following the opening of a former one, the injection of 3 draughts of the above solution put an effective check upon the discharge, healing began from that moment. The one opened previously treated with eucalyptus oil rapidly by the doctor discharged foul pus perforated, forming a very ugly fortnight which latter was afterward improved by pressure while the discharge was stopped by the hydrenophtalate.
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Plate II

1. Methyl Violet  2. Methyl Blue  3. Indigo
9. Weak Methyl Violet

a. unimolecular corpuscle which it is difficult
to differentiate into ordinary blood cells.

b. fig. 2 is an undoubted leukocyte cell.

(c) fig. 9 is a blood cell in process of deforming
the blood plate - the field in which this
occurs has been carefully marked for
future demonstration.

(d) in fig. 4 & in fig. 8 + 9 are undoubted unimolecular
cells of the white corpuscle type.

d in fig. 7 + 8 are leukocytes which have been
not free but premature rupture of the capsule
are still clumping together.

(e) fig. 3 is the nucleus of a cell which
has been ruptured in preparation for some
figure in the remains of such a cell.
Semi-diagrammatic scheme

Illustrating the nuclear changes in the white corpuscles observable in dried retained preparations of human blood.
Waddington dahlia stam, undried

a. blood plate whose capsule was disturbed by somatic change
b. blood cells with nucleoli
c. capsule faintly stained
d. a rare condition affecting cells of the blood type, suggesting that in certain cases the evolution toward the blood cell may begin earlier than the divided unnuclae stage. This cell will probably divide endogenously into two blood cell masses.
e. unnuclae white corpuscles; this type is fairly common in plus the other more uncommon
f. unnuclae white corpuscles

g. nuclei of stage
h. binucleated stage
Hemi-diagrammatic scheme of the life history of the white and red blood corpuscles.
Plate VII

Photo V
Bacillus multiformis cell

Photo VI
Blood plate - multiformis cell

Photo VII
a - uninucleus cell
b - group of blood plate

Photo VIII
Saccular sheath - type of Bacillus leewesii f. leewesii

x 750
Plate IX

Photo XIII. Methyl Violet
a = multinuclear cell
b = blood cell

Photo XIV

Photo XV
x IV + X V are from same field
x IV = orthochromatized plate
x V = non-

Photo XVI
a = small unicellular cell

X 750
Photo xix

Multinuclear cell blood plate

Photo xx

a: group of blood platelets in cell mass
b: white expanse with nuclei discharged

Photo xiv

One from obscure at end of tissue
a: very large multinuclear cell
probably derived from bone

Photo xx

Formed cell from showing the stages of nuclear division
good examples of tubercular pus
\( \times 750 \)

\[ a = \text{rues cells showing fatty degeneration} \]

rare example of blood cell in the act of discharging the blood platelets
\( \times 600 \)
Plate XII

Photo xxxv
Fibrinoid threads are seen formed by destruction of each fibrinogen.

Photo xxxvi
Coagulated blood - all the blood plates are not connected with the fibrin threads.

Photo xxxvii
Coagulated blood - all cells destroyed. Blood plate present to the last.
Plate xiii

Photo xxx

Nasal catarrh

B. meliace catarrh

Photo xxxi

Two from bovine pasteure

Photo xxxi

R-6 from bovine: epithelial of trachea

x 750
Plate x.xiv

Photo xxxii
Squamous pustule
a = peculiar bodies = nuclei of epithelial cells

Photo xxxiii
Acne pustule
a = same as in Photo xxxii

Photo xxxiii
Variety of pustule
a = ordinary pus cells
b = epithelial dermalis

Photo xxxiv
Epithelial ceci from tonsils
matter in carcinoma of stomach & pus cells.

x 750
Photo xxxv

Phos? from above... in... ficial... thin... permiscus... fatty degeneration... x750

Photo xxxvi

Another... above... a peculiar... body which stains like a muscle...

Photo xxxvii x750

Same as xxxv

Photo xxxviii x100

Surface of... clot... the number of... necropy to here
Plate XVI

Photo XXXIX

"Serrated" fasc from prepuce

\( \times 500 \)

A = epithelial derivative

Photo XL

\( B = \) free nuclei

\( C = \) peculiar body larger than a blood vessel cast but otherwise like it

Photo XLII

Penutri cutaneous

\( a = \) altered blood in process of being caused by epithelium to surface
Plate XVII

**Photo XLIII**

Thorax of human - a = epithelium (mucous)  
- b = blood vessels + connective tissue  
X 20

**Photo XLIV**

Same as above but X 100  
a = connective tissue base  
b = obliterated vessels  
c = epithelium

**Photo XLV**

Same as above but X 100  
a = connective tissue base  
b = obliterated vessels  
c = epithelium

**Photo XLVI**

Same as above but X 100  
a = blood vessels with mucous cells  
b = inflammatory infiltration  
c = hypertrophied blood
Photo XLVII x 600
Blunt Ansom - Read with
numerous keratoses &
meissneri

Photo XLVIII x 20
Scene for pseudo anther
a = upper surface - note rhabdosomes
of blood at numerous points

Photo XLIX x 20
Ulcerous anther - a = upper
b = deep surface
C = epithelium

Photo LI x 600
Barles from pseudo anther
carries abscess in rabbit
Plate xix

Photo L. x 650
Blood:

a = multinuclear corpuscles
b = lymph cell

Photo LIII

Photo LIV

Bacilli from Septicaemia
Plate xx

Photo LV
Bacilli from pseudo antumnal

Photo LVII
Bacilli from pseudo antumnal

Photo LVIII
Narcissi from blood of pseudo antumnal core